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More than 30 years ago, the personal computer, or PC, rocked the technology world, changing it forever. Ten years ago, the tech world leapt forward again when Steve Jobs introduced Apple’s first iPhone, totally changing the computing and communications landscape. Today, another shakeup in technology continues to reverberate as cloud computing sets firm roots in business and government. “It’s the biggest disruption in our lifetime from an IT perspective, bigger than the PC was 30 years ago,” said Rajiv Gupta, CEO of Skyhigh Networks and an early computing pioneer.

Computing is a relatively young business compared to others — steel, trains, phones and automobiles — that have also transformed the way we live. But unlike those other industries, computing continues to change in very big ways. That makes predicting what comes next hard to do.

But state and local governments need to know what to invest in when it comes to technology. They need to know because they don’t have the resources to make the wrong bet and then buy their way out of the problem. They are also coping with problems that require solutions that can be launched and scaled in a fraction of the time it used to take. Because of technology — the smartphone, cloud computing — citizens have become impatient and demanding when it comes to services. They don’t want to wait around as government takes months, even years, to design a new service, buy the servers and other pieces of hardware, develop the software using traditional methodologies, only to see the new program not perform as expected. Still, government can be hesitant when it comes to IT transformation.

But changes in technology and what the future might bring shouldn’t be feared. Talk to leaders in the industry and they will tell you that new technology, when adopted and applied in the right way, can help governments move faster and with better results than in the past. “We are entering the age of enterprise computing, where simplicity, flexibility and scalability are becoming real,” said Nick Psaki, principal systems engineer for Pure Storage.

Psaki and Gupta are just two of a number of business tech leaders we interviewed to find out what state and local government CIOs and their peers need to pay attention to as far the future of tech...
Technology is directly changing the way we deal with citizens and engage with them,” said Atkins. “I think we’re going to see a rapid transformation of existing public-sector processes.” That same transformation will also impact internal IT operations. Rather than spend time and money for servers and networks, CIOs and their teams will become service brokers for agencies. They will also spend less on hardware, leaving them with resources to drive more meaningful change.

“Technology is directly changing the way we deal with citizens and engage with them,” said Atkins. “I think we’re going to see a rapid transformation of existing public-sector processes.” That same transformation will also impact internal IT operations. Rather than spend time and money for servers and networks, CIOs and their teams will become service brokers for agencies. They will also spend less on hardware, leaving them with resources to drive more meaningful change. "The cost of IT infrastructure is dropping rapidly," said Gupta, regarding cloud computing. “That has led CIOs to shift away from focusing on optimizing cost to optimizing innovation.”

With a greater focus on data, better security and more nimble applications, states and localities will have the ability to craft far-reaching digital solutions to intractable problems. The state of Indiana was able to direct resources at solving a decades-long problem with infant mortality, using big data and analytics. Meanwhile, in a number of states, citizens are “talking” to artificial agents to get answers to a host of questions. For now, this kind of conversational interface is handling some mundane queries, but as Robert Knapp of NIC points out, over time, the technology will become smarter at answering more sophisticated types of questions that are on the minds of citizens and businesses. Now, that’s transformative, and it represents a future for technology that government CIOs, and the people they serve, can embrace.

What these tech-savvy leaders reveal is that, along with cloud computing, other technologies are disrupting how government operates and provides services. From artificial intelligence and machine learning to software-defined computing and agile development, a new age of computing is dawning and it allows government to create and deliver services for citizens that replicate what they are using in retail and the commercial world.

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Robert Knapp: Running Government’s R&D Shop

NIC has a unique history for a digital government services company. Launched in 1992, the company quickly saw a demand for e-government and capitalized on its know-how to become the nation’s largest firm providing portal and transactional services to state and local government. For Robert Knapp, NIC’s chief operating officer, the company’s expertise provides it with an opportunity to figure out what comes next for states and localities.

“NIC serves as the R&D shop for government,” he said. “As technology evolves, we are able to help government keep up with that pace of change. We’re able to think more of the future, how to harness the power of the latest technology and make government interactions quicker and easier and more convenient for citizens and businesses.”

That specialized expertise can translate into valuable assistance for government IT, since resources are spread so thin and there are so many demands on their time. NIC, with all of its resources, can focus on how to use technology more effectively, and is able to assist on the exploration side of things, bringing emerging technologies to government more quickly and effectively than if they had to do it themselves. One of those technologies is cloud computing, which is playing a significant role in advancing digital services, not only in terms of cost but also with speed to market. Another is something NIC launched last year: “skills” for state government using the Amazon Echo device, known as Alexa. In Mississippi, for example, residents can ask Alexa about state facts, while teens in Utah can talk to Alexa to study for their written driver’s license exam. The chat tool also allows anyone in Utah to inquire about fishing reports around the state.

“That whole aspect of ‘conversational interface’ is certainly a technology that is continuing to become more prevalent,”
Knapp said. “We’ll always have a need for the screen, but I think you are going to see more and more ability to communicate verbally for services. There was a study done this year that said within three years, the average person will have more conversations with a bot than they do with their spouse.”

Another example of NIC’s R&D lab at work can be seen in the field of virtual reality (VR). Knapp is not sure that the technology has taken a strong position in state and local government yet, but they have done some things in Wisconsin and Indiana where people can tour the state capitol virtually, without ever leaving their home or classroom. “This can help teachers who want to take their students to the state capitol, but are unable to do that, and can now do it virtually,” he said. NIC believes the role of VR will continue to spread in a similar fashion into other areas of government, such as law enforcement, public safety and other operational areas.

But AI is where the future seems to lie, according to Knapp. “The whole concept of artificial intelligence and chatbots, for example, is happening in a number of places,” he said, citing Mississippi's Gov2Go now has 300,000 users in Arkansas. Nebraska and Colorado also use Gov2Go, with many other states on the way.
recent addition of a chatbot named Missi, another method of delivering customer service to portal visitors. “You can ask questions and engage, and the device’s AI can narrow down and answer the question. Over time, the device will become smarter at answering questions.”

While government overall has been open to these emerging technologies, it is the millennial generation that has been particularly receptive to their capabilities, in part because they are demanding more convenience, akin to what has become the norm for online retail. Those expectations will continue to rise and spill over into government, according to Knapp. “As for the future, we certainly think it’s going to be radically different from today. We think people will want to engage, whether it’s with one-click payments or e-wallets or one-stop shopping … there also will be the use of biometrics for logins. It’s coming really quick.”

But technology’s future lies not just in AI, VR and other types of bleeding-edge software. It also has to do with platforms, and there Knapp sees state and local government at an inflection point. “It’s shifting from 100 percent custom-built applications for each unique instance, to leveraging data and standardized common components, to creating fully digital modules that enable data sharing and collaboration,” he said.

Knapp compares the evolution underway to quilting, in which a government enterprise takes different components and microservices and stitches them together into a digital service. “That way, you aren’t reproducing from scratch. You are still allowing customization that individual agencies need to make the solution uniquely theirs in their particular state,” he explained. “For once, you are streamlining development and delivering on the promise of code reuse, which is really important.”

One example would be the classic dilemma where a citizen needs to make an address change. Instead of repeating the procedure over and over for every digital government service, technology allows it to happen just one time, in one place. This kind of transformation could have a big impact on business-one-stop services. “Rather than having to worry about individual silos in agencies, if you see that quilt together using APIs and microservices, creating a one-stop service, you can leverage more and generate benefits that will be recognized over time,” he said.

But if government wants citizens to enjoy such a service, they have to first confront user indifference caused by the traditional bureaucratic approach to customer service. In 2014, NIC conducted a focus group that revealed citizens are confused about which government agencies they need to interact with to complete various tasks. These are government transactions that may only occur once a year. “When you boil it down, citizens don’t like having to understand and seek out government agencies,” Knapp said. “That’s why NIC developed Gov2Go, first used in Arkansas and now in Nebraska and Colorado. We’ll have several additional states taking advantage of it in the coming months.”

Gov2Go is government’s first virtual assistant. Knapp described it as device-agnostic and able to bring together an individual’s interactions with all levels of government, whether the constituent is using a smartphone, an Apple watch, Microsoft’s Cortana or an Alexa device.

“It learns about your government interactions and then it tracks those interactions and deadlines, and then more importantly it will notify you when information needs to be filed, a vehicle needs to be registered, if you have a license coming due, those types of things,” he said. “Most importantly, it will allow you to complete the transaction with a single-click payment — kind of an e-wallet of stored information.”

Arkansas now has 300,000-plus users who are engaging with Gov2Go. The service now interfaces with the Apple TV. What’s important is that Gov2Go will not tie down citizens to a particular type of computer screen, but will allow them to capitalize on all different kinds of interfaces. Yet reality shows that the device more and more citizens want to use when engaging with government is their mobile device, and NIC, along with its government partners, has adopted a mobile-first approach to digital services, whether it’s a mobile phone or iPad.

“Mobile is becoming the de facto expectation of today,” said Knapp. “Governments are going to have to make sure their services can be delivered, regardless of device. We’ve tried to do that from the standpoint of making sure services are device-independent, as well as looking forward to leverage APIs that will capitalize on conversational interfaces, such as Gov2Go.”

Without question, millennials have shown that mobile technology is here to stay, and we’re only going to see that continue and become more prevalent as we go forward.”

“Within three years, the average person will have more conversations with a bot than they do with their spouse.”

Mississippi recently launched a chatbot named “Missi,” which was built to supplement customer service on the state portal.
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NIC leads the industry in building citizen-centric digital government solutions. Our latest innovation is Gov2Go — the first personal assistant for government.

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  - Personalized content & services for each citizen

- **EASY TO ADOPT**
  - Low cost, low impact, and low risk for government
  - A flexible overlay to complement any existing system

- **PROVEN TO WORK**
  - Already in use in 3 states
  - 500,000+ users

For more information on Gov2Go, visit: [www.egov.com/gov2go](http://www.egov.com/gov2go)
Rajiv Gupta: Chief Executive Officer, Skyhigh Networks

The Sage of Security

To understand government’s dilemma with IT security today, how it got to this painful juncture and how the problem could be resolved, you have to understand the incredible disruption brought on by cloud computing. But that requires a knowledge about how cloud computing got its start, how it was designed and how security can be used without stifling the positive impact of everything-as-a-service.

Rajiv Gupta understands cloud like few others, and that knowledge gives him insight into today’s computing environment and where it can lead us. Gupta is CEO of Skyhigh Networks, a leading cloud access security broker. But his roots run deep as far as technology is concerned. He has more than 45 patents in his name, and he helped design the earliest Web services technologies, some of which have been inducted into the Smithsonian National Museum.

He also played a key role in the development of cloud when he worked on utility computing back in the 1990s at Hewlett-Packard. From the very beginning, Gupta said the idea that technology should be a service that anyone could use made perfect sense to him. “I remember buying a laptop back in 1991 and realized it would be obsolete in 12 months, when another model would be available with a new microprocessor, more storage, more memory and so on,” Gupta said. “So I asked myself, ‘Why should I buy something that’s going to be obsolete so soon? Why can’t I use it — or software tools — as a service?’”

That desire for convenience, cost savings and increased productivity became the harbinger for what is cloud computing today. “It is the biggest disruption in our lifetimes from an IT perspective, and it’s going to be bigger than the PC was 30 years ago,” Gupta explained.

Why so disruptive? Gupta ticks off a number of reasons, including the openness that is one of the hallmarks of the Internet and, by extension, now cloud; the ability...
to get things done; but perhaps most importantly, it has made data the most important IT asset a government can have. “In the old days, data was entombed in the mainframe. Then it was encased in personal computers. Today, it has become dispersed, and it is security’s responsibility to enable data to travel where it needs to,” he said. At the same time, the cost of IT infrastructure is dropping rapidly. That has led CIOs to shift away from focusing on optimizing cost to optimizing innovation, which is easy to spin up thanks to the convenience that the cloud brings.

But the adoption of the cloud moved so quickly that security hasn’t caught up yet. Trying to bolt on security to the cloud can get in the way of how people expect to work. It’s a significant issue. Convenience is in opposition to security, Gupta pointed out. “We have to understand that convenience is paramount today. If we provide security that hampers their convenience, they will just go around us,” he said. “So we need to start thinking of security as enabling convenience rather than hampering it.”

Despite the dichotomy, Gupta said it’s Skyhigh’s mission to design and deliver cloud security that is more convenient, productive and agile for its customers. “Our mission is to, first, take out the friction [caused by security tools] and, second, create seamless consumption,” he said.

Understanding these underlying motivations that drive cloud has allowed Skyhigh to design the kind of breakthroughs in security technology that make it so exceptional, according to Gupta. “It’s the concept that you allow people to use their own device, their own network and the ability to access a cloud service, but you enforce security around the data, which is what you care about. You don’t require them to download
agents onto their devices, because they cause friction and people won't do it."

Another breakthrough in cloud security is to look at the behavior of an interaction to figure out whether the person is who they say they are, explained Gupta. Humans are going to make mistakes, so you have to discern whether the person simply made an error that triggered a phishing breach, or if there is something in their behavior that indicates they might be someone else — a hacker or foreign agent — even if they have the right password.

This is where technology's latest tools — artificial intelligence and machine learning — can be brought to bear on cloud security without slowing down productivity. "Security won't work if it becomes an impediment, requiring people to download agents or locking down devices or even the network," he said. "Those tactics aren't relevant today."

The same technology can be used to understand the behavior of software applications that reside in the cloud, said Gupta, who also sees AI and machine learning helping chief information security officers (CISOs) overcome cumbersome security management protocols and policies. "That's another area where people make mistakes," he said. Instead, AI techniques can be used to infer what security policy might be applied in a given situation.

So is government about to get an upper hand on the cybersecurity problem? "I think we are very much at a turning point," Gupta said. But the main factors for change have to do with the simple fact that owning and running IT is becoming too expensive for government, and there isn't enough talent out there to staff IT organizations, run the servers, manage the applications and keep everything secure. "Cloud services are much more secure than anything a government can do on its own," he said. "I'm better off using Microsoft Office 365 than trying to run the server and application on premise myself."

By moving applications into the cloud, government can focus on protecting what is important, which is its data. The rise in data's value is the reason the bad guys are going after government with greater ferocity. "Not so long ago, the bad guys were after credit card numbers, which governments typically don't store. But today, anybody who has data is a target, and that makes government, with its data on citizens, a very rich target. That's why governments have to look at more modern ways of protecting their data, in a much more cost-efficient way," he said.

Despite all the uncertainties that disruptive technologies bring to society in general and government in particular, Gupta does not hanker for the old days, when technological change happened at a slower pace and was somewhat less challenging. By stripping away what was cumbersome and making tools easy to access and use, technology, and the cloud more specifically, has unleashed innovation that has led to some amazing breakthroughs, whether it's in the field of medicine, agriculture or social services. "It is breathtaking what we can do today," said Gupta. "Twenty years ago, the CIO's chief worry was about the technology they owned and how they provided it to their customers. Today, they can focus on applying innovation in so many different areas. Those who embrace this change will be the successful ones. They are blazing new paths."

"Cloud computing is the biggest disruption in our lifetimes from an IT perspective, and it's going to be bigger than the PC was 30 years ago."

Did you know? Of all the documents with sensitive data in the cloud, more than half are stored in Office 365.

Each month, more than 71 percent of organizations have at least one compromised Office 365 account.

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SOURCE: SKYHIGH NETWORKS
Pursuing a “cloud-first” mandate, one state eagerly sought the advantages of using Microsoft Office 365 to support collaboration, especially between internal and outside customers and partners.

However, it soon found itself facing an increasingly common challenge: The state’s traditional network security controls, and those built into the cloud-based software services, were not adequate to protect its 62,000 Office 365 users from inadvertently sharing sensitive data. The state also needed to guard against potential breaches via compromised accounts and insider threats.

The solution was adding Skyhigh’s Cloud Access Security Broker (CASB) to provide seamless visibility, threat protection and compliance — while enforcing data security policies across its cloud services.

SECURING CLOUD SERVICES WITH A CASB
Approximately 50 percent of cloud security incidents occur when users bypass network security controls by sharing internal-only documents with an outside partner or make other common mistakes.

Given that reality, Gartner recommends organizations should “strongly consider adding a CASB to create more robust data loss protection, user behavior analytics and policy enforcement capabilities.” Gartner predicts that 65 percent of large enterprises will utilize a CASB by 2020. Today, 40 percent of Fortune 500 companies rely on Skyhigh to provide that protection.

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Skyhigh CASB solutions provide the industry’s only single point of control to securely cover all users across all devices and cloud services.

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Chris Atkins: VP, Digital Government Transformation, SAP

The Data-Polic
What happens when sound governance, breakthrough technology and a shift in culture coalesce around an intractable problem? The story of how Indiana managed to lower its infant mortality rate is a classic example of what a state can do when it tackles a major policy issue using breakthroughs in technology to solve a vexing problem, according to Chris Atkins, former director of Indiana’s Office of Management and Budget (OMB) and now vice president of Digital Government Transformation at SAP.

**The problem** Indiana faced was stark and hard to ignore. “Indiana had an infant mortality rate that was unacceptably high, and reducing that rate was a priority for Gov. Mike Pence,” Atkins said. “He needed to know what strategies he could adopt to reduce it and what strategic initiatives he could fund in order to reduce that rate.”

Specifically, the governor wanted to know why some infants were dying in their first year of life and others weren’t. The vital information would allow state policymakers to target the most vulnerable with the right solutions. So far, the state had been pursuing a policy that wasn’t producing results. “There had been a 20-year effort to reduce the rate, and the prevailing belief at the time was that infant mortality was caused by pregnant moms who either smoked cigarettes, did drugs or drank too much alcohol,” Atkins said.

The state’s policies centered around trying to lessen those behaviors. The problem was that Indiana’s rate of infant mortality had stayed the same for 20 years while the national rate declined. “Efforts to reduce those negative personal characteristics were not working,” he said.

State officials were evaluating their lack of progress at a particularly opportune time, Atkins explained. “Back in 2012-13, we had this idea, when big data was on the upward tick of the hype cycle in the IT world, that the state had lots of data on mothers and infants, and if we brought [the data] all together in one place, we might determine and pinpoint the actual causes of infant mortality, or confirm we were on the right path, and just needed to manage the programs in a different way,” he said.

They went after approximately 50 data sets from five different agencies. “We wanted to include every bit of data to see why this is actually happening,” Atkins said. While some agencies willingly obliged, others were reluctant, raising concerns about privacy and security, and, more fundamentally, about sharing the data in the first place.

To resolve the issue, then-Gov. Pence issued an executive order requiring agencies to share data with OMB, with
processes in place to protect and secure data. That was the shot in the arm the project needed. The technical problem Indiana faced was that it had data coming from different transactional systems, and those systems weren’t all on the same platform or speaking the same computer language.

“For our IT challenge, we needed a single analytics platform where we could do the data science, where we could extract structured data from any data source and do the analytics, using the algorithms,” Atkins said.

The big question was whether the state could break down the silos that existed because of governance and legacy coding. The problem was solved using SAP’s Hana analytics platform, which overcame the technical hurdles standing in the way of the data science.

“Besides breakthroughs on the governance and technology side, we had a third breakthrough, which was culture,” explained Atkins. “We shifted the culture in Indiana from one where everyone kept their data in silos to a culture where data sharing was the expectation.”

In the end, the exercise revealed that access to prenatal health care, not smoking, drinking and drug use, was the real issue keeping the state from improving infant mortality rates, leading to a dramatic pivot in the use of state resources based on real data.

Harnessing big data and analytics, together with better governance and cultural changes, is just one example of a larger trend underway in government IT, according to Atkins. It’s a trend that includes citizen engagement, the consumerization of technology (i.e., the smartphone revolution) and greater collaboration among agencies, with IT as the lubricant for transformation.

“Technology is directly changing the way we deal with citizens and engage with them,” Atkins said. “Whether that’s how we register our cars, how we pay our taxes or how we find transportation options — all of that is up for grabs. I think that’s where we are seeing a lot of potential right now, in terms of transformation.”

A project like Indiana’s shows that it’s great to grab all the agencies’ data and bring it to a central platform where the groups can collaborate on a problem like infant mortality, recidivism or opioid abuse. But it raises the larger question of public sector’s IT architecture and infrastructure, which needs to be designed in a way that supports these kinds of cross-cutting initiatives.

“What might help answer these and other looming questions are a host of new technologies beginning to disrupt — and transform — the public sector. For one, Atkins cites the potential of blockchain technology to advance government transparency. He also predicts many advances on the horizon in the machine learning or AI space.

Putting analytics to use to make headway on Indiana’s stagnant (and high) infant mortality rates required breakthroughs in three areas: governance, technology and culture.

“State government is running such incredibly complex processes, like tax filings and welfare benefit applications,” he said. “Machine learning has the potential to reduce the rate of error that can exist in those types of processes and also help in detecting fraud, waste and abuse. We are on the cusp of seeing major breakthroughs with that type of technology. When combined with the capability and platforms that are necessary to do analytics and machine learning, I think we’re going to see a rapid transformation of existing public-sector processes.”

Leveraging new technologies to improve public policy and services is the goal of any leader. For Atkins, the opportunity to see how it is done has been one of the rewards of working in the public sector. “The two governors I worked for — Mike Pence and Mitch Daniels — I learned a lot about leadership from both of them. Mitch Daniels is who I first learned my love for data from, and the need for data for making sound decisions. Mike Pence is who I learned how to inspire people to buy into a vision from, and join me with that vision.”

Atkins has also learned about the right way to merge technology and public policy from Stephen Goldsmith, the former mayor of Indianapolis and former deputy mayor of New York City, now with Harvard’s John F. Kennedy School of Government (and a columnist for Government Technology magazine). “He did a lot on data analytics,” Atkins said. “Some of the work he did with [former] Mayor Mike Bloomberg and then combining the transformative vision with the business processes in the public sector, using big data and analytics to enable that transformation, is something that I have definitely taken from my relationship with Steve and have appreciated to this day.”
SPONSORED CONTENT

Take the State of Indiana: Using the SAP HANA® platform and data science through its R integration, officials gained a 360-degree view of the state’s growing opioid problem and learned to address it more effectively. By combining disparate data feeds related to forensics, vital records, treatment centers, pharmacy theft, and police data in new ways, the Hoosier State gleaned new insights into the complex issue. Officials were able to visualize the problem by county using geospatial maps. This allowed the state to strategically allocate new treatment centers and tactically distribute opioid anti-overdose drugs to local police.

Indiana is harnessing the power of the SAP HANA Platform to study other complex issues with a holistic approach. The state is breaking down data silos to analyze problems like criminal recidivism, fraud, education and workforce, and traffic safety by leveraging cutting-edge technology.

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Nick Psaki never set out to work in the field of computer storage. But a 20-year career in the military, including work in Army intelligence, where he had access to vast quantities of information for analysis, gave Psaki first-hand experience with the need to optimize storage. Frustrated with his inability to leverage data to make timely decisions, Psaki knew there had to be a better solution. Today, Psaki is a principal engineer for Pure Storage, where he helps government agencies with flash storage system architecture.

The story of flash storage and how it has become a powerful component in government computing requires an understanding of the changes underway in other areas of the IT ecosystem. It starts with better networks and faster transmission speeds that have ushered in a new era of innovation, according to Psaki. “Just as bandwidth has seen dramatic improvements over the last 10 years,” he said, “CPU processors have gotten tremendously more powerful, which has enabled a significant improvement in data processing capabilities. It’s like building an incredible car: big engine, big body and more. But one problem: same tires.”

Flash storage systems can store about 10 times the amount of data in 1/10 the space, consuming 10 percent of the power of traditional systems.

Those tires are, of course, the existing technology for storage, which hasn’t seen significant change or overall performance improvement in the hard disk drive for the past 30 years. “We have systems that can process billions of instructions per second, but they rely on a storage mechanism that can only process hundreds of I/Os per second, which is relatively slow. So we’ve essentially got a Ferrari that is mounted on motorcycle tires,” said Psaki.

The result: Applications have become hindered by storage performance. That’s where Pure Storage enters the picture with its unique blend of designs and solutions involving innovative hardware. “The platform we chose that would give the right kind of performance improvements along with the enterprise reliability was flash,” explained Psaki. “We set out to create hardware and software that was specifically tailored to NAND flash, which has started a revolution that has taken hold in the enterprise technology space.”
Bringing flash into government presented a unique opportunity, but also special requirements. “Public-sector infrastructure has a tremendous scale challenge,” he said. “People don’t appreciate how much data and processing takes place, whether at the federal or state and local level.”

Psaki explained the first of a number of changes flash brings to government: “One of the benefits of building memory-based storage systems is that you can shrink the footprint of the hardware required, which has cascading effects,” he said, including less floor space, less rack space, less cabling and a more efficient overall operation.

The impact of flash lies not just in streamlined performance. It also has security implications. According to Psaki, storage is the foundation of the enterprise, and a secure enterprise needs to be built on a secure foundation. “In a day and age where security, awareness and threats are on the increase, the industry has to make a conscientious effort to build systems that enable government to ensure the protection and sanctity of the data they are housing, because public-sector data is different from commercial data.”

So what will tomorrow bring as state and local governments turn off their spinning disks and rely more and more on flash storage? The maturation of flash presents some potentially transformative changes to the IT landscape, according to Psaki.

“Across the industry, we are seeing a necessary transformation in terms of the protocol and buses that connect flash storage infrastructure to systems,” he said. The shift isn’t so obvious. Psaki compared the change to the evolution from watching TV on a cathode ray tube to streaming content on a high-definition television.

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Government is one of the most challenging environments to innovate in.

"We're going to see the consolidation of the infrastructure stack into a component that is able to provide the resources to do all of these things all at once," Psaki said. "We are entering the age of enterprise computing where simplicity, flexibility and scalability are becoming real."

For Psaki, his fascination with technology and desire to find better ways to apply the advances that it can trigger dates back to his long career in the military. "While I was in military intelligence, we were collecting and processing data that was going to help us make smart, timely and informed decisions to reduce risk and gain a competitive advantage or insight."

"The specific applications are contextual, but the fundamental processes are all the same. What drew me to this initially was that I had incredible amounts of information available to me, but I was unable to leverage it and make relevant, timely, smart, accurate decisions."

Looking back, those were the early days of data analytics. Technology's come a long way since then. "Storage is really the last part of IT that needed to modernize and that was why I was drawn to it. So, I was the accidental storage guy, a systems engineer focused on the broken component."

A career in the military came naturally to Psaki. "I grew up in an Army family. I was a third-generation enlisted soldier. It's been the family business," he said. It also made him aware of what makes public service so unique. "People expect more out of government all the time," Psaki said. "Government workers are a group of people who are incredibly dedicated to serving their neighbors. This is acutely true at the state and local level. Even the feds want to be responsive to constituents, responsive to lawmakers. They write the laws, so they have a vested interest in compliance, in doing it themselves."

Now that Psaki works in the private sector, he appreciates the role he plays in helping government deliver on its mission. "I want to help them see a path to modernization that is responsible as far as the utilization of taxpayer dollars, but also shows that government can innovate and lead the way," he said. It's rarely a simple path. "Government is one of the most challenging environments to innovate in. It's an incredibly challenging environment to procure in and it's highly variable. They don't necessarily know which way the cookie is going to crumble."

"We have systems that can process billions of instructions per second, but they rely on a storage mechanism that can only process hundreds of I/Os per second, which is relatively slow. So, we've essentially got a Ferrari that is mounted on motorcycle tires."

As the use of disk drives fades, state and local governments are going to see incredible advances in performance. "Look at all the performance and capabilities that are now packed into the smartphone," he said. "We no longer need separate cameras, GPS devices, radios, music players. They all exist in one device."

Take the metaphor of the smartphone and extend it to enterprise IT systems in government. It means more consolidation of functionality. Historically, people would procure one system for doing databases, another for human resource applications, another set of systems for Web-based applications and yet another system for ERP. Going to help us make smart, timely and informed decisions to reduce risk and gain a competitive advantage or insight."

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Breaking It Down
I/Os: inputs/outputs
NAND flash: a stable type of storage technology that doesn't need power to retain data
A Data Platform for the Cloud Era

Data is everywhere today, and organizations have much to gain by putting that data to work. But legacy mainframe and client/server era technology and processes simply can’t cope with the explosive growth in data and the need for real-time analysis and agility. Simply put, today’s cloud model of computing demands a new model of infrastructure.

Pure Storage’s Data Platform for the Cloud Era was built to bridge the gap between traditional and new stack modes of IT and agile application development. We put data to work with a platform that supports today’s volume, velocity and variety of data. Our platform enables governments to accelerate new data-driven applications, derive valuable insights, boost agility and simplify hybrid cloud development. All of this leads to substantially reduced costs and complexity.

The Pure Storage Data Platform for the Cloud Era is:

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- **EFFICIENT**: Consolidate all data, whether block or file, structured or unstructured, into efficient all-flash storage that takes 10X less space, power and cooling.
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Chris O’Malley: Chief Executive Officer, Compuware

Powering Unique IT

The world of information technology is brimming with new, disruptive trends, from data visualization and artificial intelligence to blockchain and virtual reality. It’s easy to be dazzled by the potential of these bright and shiny tools and forget about what has been the bedrock of government computing for more than 40 years. Some may scoff at the fact that states and localities still use mainframe computers. They’re called “legacy” for a reason, right?

But don’t tell that to Chris O’Malley, CEO of Compuware, the Detroit-based mainframe software firm. Myths about the mainframe have been haunting the market for years, so he’s out to dispel them. “The most secure, most reliable and best-performing platform, with the most cost-efficient total cost of ownership, is the mainframe platform,” he said.

O’Malley, who has been in the IT business for more than 30 years, backs up his statement by pointing out that research by MIT and Gartner has shown that the mainframe, as a lightly distributed platform, has lower IT costs compared to heavily distributed platforms, including cloud technology. Not is it just empirical evidence that proves the mainframe is relevant. O’Malley makes the hard-to-refute point that mainframe technology has been around for 40 years and, unlike some other technologies, it continues to be maintained, refined and updated.

Is O’Malley against cloud computing? Just the opposite. As CEO, he has mandated that his firm take every piece of distributed infrastructure out of Compuware’s data center. He mentions email as just one example of a commodity service that works far better in the cloud.

“More than 90 percent of CIOs say the mainframe will be here for the next 10 years and beyond. They don’t say that about anything else.

Keeping the mainframe alive and relevant might seem like a quixotic mission, but O’Malley is extremely confident about big iron’s future, and plenty of people back him up. “More than 90 percent of CIOs say the mainframe will be here for the next 10 years and beyond. They don’t say that about anything else,” he said.

If longevity is one of the mainframe’s hallmarks, so too is innovation. Compuware has released a new product for 11 quarters in a row. The firm builds all of its software using agile development and scrum techniques. “We are a mainframe software company, but visitors see a company that looks more like Uber or Amazon. The mainframe can do anything any other platform can do. Experts who tell you it can’t be done are lying,” he said.

Keeping the company innovative isn’t easy, and it comes down to having an inventive and inspired workforce. The company has succeeded in recruiting computer scientists who are looking for a challenge to write software code using a variety of programming languages, including the classic COBOL. O’Malley has also used his leadership skills to help existing Compuware workers reinvent themselves as masters of agile and DevOps.

He said it wasn’t easy, but he sees it as his job to help people see the value in making the transition. It’s a message O’Malley thinks will resonate with government CIOs. “A lot of leaders don’t think people are willing to change, but it’s poor leadership that can’t lead the majority of those people across the bridge,” he said. “People can change. It’s a poor leader who doesn’t make that happen.”

Stable IT environments that support innovation need three things, according to O’Malley:

1. Operational efficiency
2. Sound cybersecurity practices
3. A focus on citizens

and at less cost than if operated internally. But the mainframe exists to power what is unique in the IT world, and for government that covers a wide spectrum of operations and services. “There’s only one federal IRS tax system on the planet,” explained O’Malley. “There’s no cloud service you can buy that’s the equivalent.” Nor can you outsource an operation like that, he added.

Given the need for different platforms that can serve different requirements, O’Malley argues that cloud-first strategies, which have gained popularity in government, are misplaced. “It should be citizen first,” he said. “You need to understand the idea of innovation and how it relates to certain customers, and the kinds of services they need, such as improving how taxes are filed.” To O’Malley, it’s completely naïve to center the solution on a strategy that advocates a single platform, such as cloud. “You’ve got to center it around citizens and how you serve them.”

In fact, O’Malley believes state and local CIOs need to focus on three key issues in order to provide a stable IT environment while also allowing innovation to flourish. First is the need for operational efficiency. Second is cybersecurity — protecting data and the integrity of government’s IT systems has become crucial, he said. Finally, as he mentioned before, any IT strategy, program or solution must be measured in terms of how it serves the citizen.

“Tech dollars need to be repurposed in ways that actually make a difference in the area that counts most, which is serving citizens,” said O’Malley. “I think it’s ridiculous for technical platforms to come first. It’s always going to be the citizen — and state and local CIOs must continue to put them first and foremost.”

O’Malley cited how a company like Amazon has managed to rise to the top by focusing obsessively on its customers. IT should never be about the firm, or government, for that matter: O’Malley advocates for CIOs to work directly with their elected leaders. “You want digital services to become integral to what a governor or mayor does in terms of creating better services,” he said.

That can’t happen if the CIO is placed lower in the organization, such as in administration, where the goal is mostly to drive efficiency and cut costs. “There is a process to inventing and delivering better services,” O’Malley explained. “Proximity counts when it comes to innovation. In order to translate a mayor’s or governor’s ideas into digital activities, you’ve got to have a reporting structure that can build relationships, that taps into the consciousness of the governor in terms of what is important.”

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Working Code is **Gold**

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Tim Merrigan:
Vice President of State and Local Government and Education, VMware

The Virtualization Visionary
Server virtualization. It sounds so routine and ordinary today, like “client-server” or “local area networks.” But unlike previous tech trends, some of which seem to have faded away, virtualization continues to disrupt and transform. It also differs from past shifts in technology in that it was actually an easy concept to sell, according to Tim Merrigan, vice president of state and local government and education at VMware. “If a customer had a thousand servers, we could go in, reduce that footprint and they would have 100 servers, running the same programs with significant savings, reducing maintenance and power consumption,” he said. “That was an exciting time.”

The ripple effect of virtualization and how it has brought software to the world of hardware for computing, networking and storage continues to spread outward, explained Merrigan, who worked at storage giant EMC for 12 years before joining VMware. “It has led to some quantum leaps in how you manage those assets, how you provision, how you automate them,” he said.

It has also brought significant benefits in the form of increased savings and levels of security, and has extended automation deep into the IT framework, he added.

For state and local governments, the moment hasn’t come too soon. With workforce levels still low and unlikely to rebound as older workers retire, the software-virtualization revolution and what it means in terms of automation will help government agencies bridge the workforce gap while increasing efficiency, services and productivity.

It’s happening because virtualization allows state and local IT organizations to create a cloud-like experience on premise. As software-defined data centers, networks and storage become the norm, it allows the on-premise cloud foundation to extend into the public cloud as well, according to Merrigan. “That creates great economies with platforms, great efficiencies, but it requires new IT policies or management procedures to maximize savings and user experience;” he said.

Virtualization creates two enormous opportunities for government IT. First, it opens the door to provisioning, which has proven to be transformative in the private sector. Government is burdened with seasonal workloads, which spike at certain times of the year, according to Merrigan. The solution is to “burst that [computing need] out into a public cloud,” he said. “Meeting the needs of customers is critical, and it can be done on or off premise depending on requirements and capacity. You can provision workloads very quickly, depending on your profiles and needs. It’s a much more efficient way to respond to the demands of individual agencies.”

Merrigan explains how full-scale virtualization can change how governments do business. “It gives agencies the ability to roll out new applications based on new demands from the community they serve, and do it much faster than in the past. Citizens now expect the same kind of service from government that they get from any application provider, which is find an app in the cloud, download it and use it that very day;” he said. “State and local governments can no longer claim...”
it’s going to take 12 months or more to stand up the server needed to run a new app. The software-defined data center allows provisioning — and the launch of new services — to happen almost immediately.”

The second big opportunity comes when an IT organization “decouples” itself from the heavy lift that is required to maintain a significant hardware foundation and all of its patching, maintenance and other requirements. “Now you can take your IT team out of the day-to-day grind of operating a data center and take advantage of the advances in software across the spectrum,” Merrigan said. “It’s a more agile environment when you are dealing with software versus hardware.”

It’s at that point that an IT organization can start to transform and become a broker of IT services for the agencies rather than spending time and resources maintaining large rooms full of hardware. “IT can profile a workload, based on its performance, availability, certification and other requirements to meet service-level agreements, they can help an agency decide where the workloads should reside and then easily move them. That's the difference between a true service broker versus the legacy data center operator they were in the past.”

Already, a number of government IT organizations are in the early phases of operating as IT service brokers. And the trend will grow stronger as more organizations remove themselves from the data center business and focus on delivering on the mission of their agency customers. It’s a win-win for IT organizations and agencies, according to Merrigan. “In the broker model, there would be a liaison from IT who makes sure the workloads should reside and then easily move them. That's the difference between a true service broker versus the legacy data center operator they were in the past.”

State and local governments can no longer claim it’s going to take 12 months or more to stand up the server needed to run a new app. The software-defined data center allows provisioning — and the launch of new services — to happen almost immediately.

“Creating a software-defined computing environment will seem foreign and new to some governments today, but already a significant number have moved down this path and are wondering what comes next.” Merrigan said. “It’s going to be a gradual process. It calls for transparency so agencies understand they are not overpaying for the service from IT.”

Merrigan sees government evolving toward a hybrid architecture, with some on-premise cloud and some off-premise, rather than being purely public or private. “But what does that look like and what policies and processes need to be changed to make that happen?” he asked.

Another stumbling block is the workforce challenge. Long-time workers have become attached to how things were done in the past. Letting go of the servers, the data center, which has been around for so many years, and learning how to provision and broker can make change very hard. “You have to manage through that change and do it in a nonthreatening way,” Merrigan said. “But it can be an opportunity to learn new skills and make a quantum leap in how services can be delivered.”

It’s the kind of change that every industry and sector, not just government, is facing. Creating a software-defined computing environment will seem foreign and new to some governments today, but already a growing number have moved down this path and are wondering what comes next. “It's going to be very different from what is offered today. The IT organization will be structured more along the lines of analyzing different workloads to figure out how to move a service from one cloud to another, from on-prem to off-prem.”

Merrigan believes state and local government, as well as education, have a good chance to leapfrog over other sectors when it comes to virtualization, software-defined computing and IT brokering. He’s already seeing some success in a number of agencies, large and small, including the New York City Housing Authority, California’s Department of Natural Resources, Massachusetts Institute of Technology and Georgia’s Fulton County Schools.

Merrigan said it’s rewarding to see a public agency or school, with fewer resources than the private sector and limits on how much talent it can hire, make the effort to bring about meaningful change through technology. “I’ve worked with many different industries, including some of the biggest Wall Street banking firms, but I have always gotten more satisfaction working with state and local government. They don’t have the deep pockets of the other firms, so they really have to work at being much more efficient with the resources they have. When we can help them evolve and transform, there’s a lot of satisfaction in that.”
All government agencies desire to step confidently into the future. Yet obsolete processes and legacy systems continue to hinder delivering on customer service goals, cost avoidance and operational efficiency.

As a world leader in virtualization, VMware offers a pragmatic path forward with software that allows federal, state and local government to modernize in four key areas:

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Today more than ever, government agencies must demonstrate value and return on investment to achieve current service requirements, while supporting tomorrow’s modern workforce. To learn more about how VMware can help, visit: [www.vmware.com/government](http://www.vmware.com/government)
Acknowledgments

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Special Report

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 and writes the “Tech Talk” column for Governing. Tod is also the author of several books on information management.
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