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Crafting Your Legacy to Shape the Future

Quick — what's your legacy?

The term "legacy" has many different meanings — some good, some bad. But after years of work innovating under pressure, it's a perfect word to encapsulate everything it means to be a public IT leader. Legacy is about the past: the so-called legacy systems that we inherited from decades ago (and on which some public agencies still disproportionately rely). But it also conjures images of the present and future, of where we are today and where we are going.

IT leaders should think of their legacy early and often throughout their careers. In fact, it's probably the first and the last question that crosses any top executive's mind upon taking a post. What will my work mean to this organization after I am long gone? What foundation am I laying to ensure a brighter future?

It may seem selfish, or at least a bit self-serving, to consider one's legacy. But the exact opposite is true. Thoughtfully crafting a legacy is the highest form of service that an executive can render to the team that he or she leads. Staying focused on your legacy will insulate you from the thousand vagaries and million distractions that will descend on your desk. Considering your legacy puts the forest first, and the trees second.

In this paper, we'll take a look at legacy from three perspectives: past, present and future. First, we will courageously come to terms with the past. Then, in the present, we will boldly transform our organizations. And we'll close by considering the bright future ahead. ■

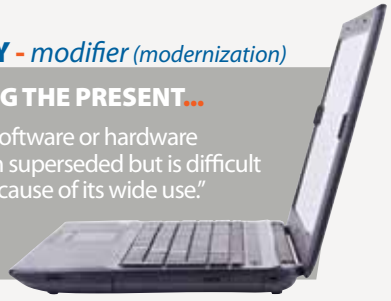
IT MAY SEEM SELFISH, OR AT LEAST A BIT SELF-SERVING, TO CONSIDER ONE'S LEGACY. BUT THE EXACT OPPOSITE IS TRUE. THOUGHTFULLY CRAFTING A LEGACY IS THE HIGHEST FORM OF SERVICE THAT AN EXECUTIVE CAN RENDER TO THE TEAM THAT HE OR SHE LEADS.

THE THREE DIMENSIONS OF CRAFTING A LEGACY:

1 / LEGACY - *noun*

COMING TO TERMS WITH THE PAST...

"A thing handed down by an ancestor or predecessor: the legacy of ancient Rome."



2 / LEGACY - *modifier* (modernization)

MASTERING THE PRESENT...

"Describing software or hardware that has been superseded but is difficult to replace because of its wide use."

3 / LEGACY - *noun* (legal term)

BUILDING FOR THE FUTURE...

"A gift of personal property or money to a beneficiary (legatee) of a will."

Source: Definitions adapted from the Oxford English Dictionary and the Farlex Free Dictionary.

Marshaling the Courage to Overcome the Past

As a technology leader coming to terms with your own legacy, ask yourself the fun questions: What advantages do I have? What did my predecessor do right? But don't forget the hard ones: What are our shortcomings?

Before we start, let's be clear about what we mean by "past" in this section. We aren't providing a history lesson, nor are we waxing poetic about the bygone days of punch cards and magnetic tape. We certainly are not implying that the CIOs, organizations and technologies that we profile in this section are stuck in the past. Far from it.

This story is about leaders who took hold of the past with both hands and purposefully charted a path to transformation in the present. It is also about the assets and liabilities that must be considered during such a transformation. Because let's face it: Some legacy systems have been in place for 20 to 30 years, or longer. Our organizations are also often saddled with legacy people and legacy business processes. All of these are legacies of the past, and will confront a CIO the first day on the job.

Transforming Through Leadership

Take Texas CIO Karen Robinson, for example. When Robinson assumed her role, she inherited some Texas-sized problems. She took on an agency that was replete with negative press, missed deadlines and dissatisfied agency stakeholders. The agency only narrowly survived intact when the governor stepped in with a last-minute veto.[1]

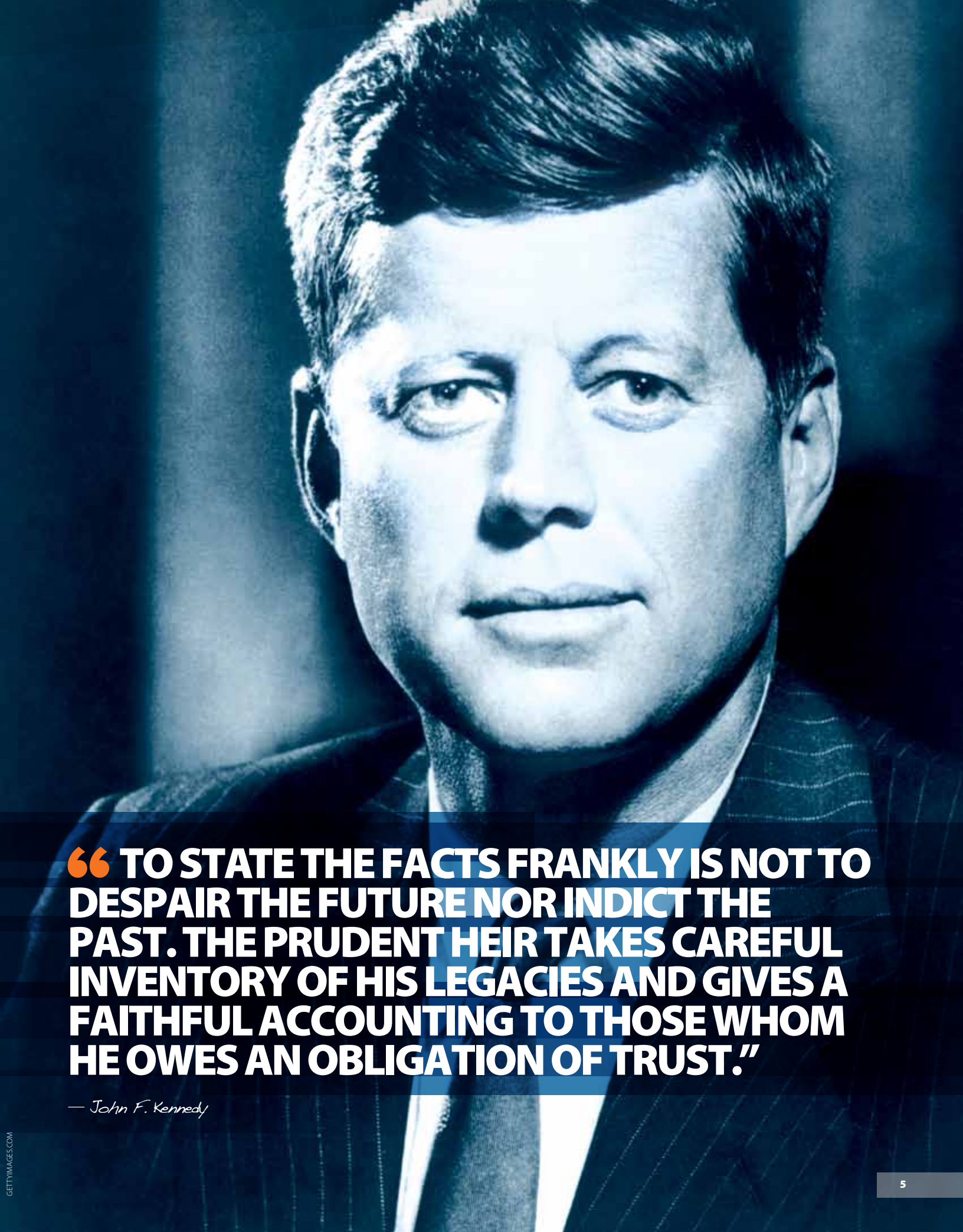
To call this "legacy past" a challenge would be a dramatic understatement. The difficulty seemed larger than any one agency head could take on. As the song goes, Robinson had "a long way to go, and a short time to get there."[2]

"One of the first challenges that I had was with the data center project," said Robinson. "We put the governance structure together, and I went to all the executive directors of the agencies involved in the project and asked them to be part of the solution." She reached out in earnest, not just as a formality. "There was an opportunity to sit at the table and help me identify what we needed to do," said Robinson. "The bottom line was we needed a new solution for the data center project to become successful."[3]

The ensuing Texas transformation that Robinson led was founded on bedrock principles of leadership. Thomas Johnson, chief communications officer for the agency, described Robinson's approach this way: "going to each and every stakeholder with [her] hand outstretched, with an open attitude, and telling someone directly, 'This hasn't worked ... we need your help. We need your advice to move forward and make this a success.'" As it turned out, the key to the turnaround wasn't found in the heady realm of procurement law or the bits and bytes of some newfangled computer code. It all depended on a good, old-fashioned character virtue typical of magnanimous leaders: humility.[4]

Fast-forward nearly three years, and the picture is brighter than ever. Texas is winning awards and positive press from coast to coast. Recently, the Texas House of Representatives passed a bill that mirrors the recommendation of the Sunset Advisory Commission to extend the life of the agency through 2021 — a remarkable achievement.[5] The bill is currently under consideration in the Senate. Forbes.com recognized DIR as "one of the few, if not the only, live operational models of cloud brokerage use within a government context."[6]

As a technology leader coming to terms with your own legacy, ask yourself



“TO STATE THE FACTS FRANKLY IS NOT TO DESPAIR THE FUTURE NOR INDICT THE PAST. THE PRUDENT HEIR TAKES CAREFUL INVENTORY OF HIS LEGACIES AND GIVES A FAITHFUL ACCOUNTING TO THOSE WHOM HE OWES AN OBLIGATION OF TRUST.”

— John F. Kennedy

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the fun questions. What advantages do you have? What did your predecessor do right? What is unique and positive with your organization? But don't forget the hard questions as well. What are my liabilities? What are our shortcomings?

Overcoming Legacy Skills

As a CIO, you also have to take stock of the employees who keep your government agency running and interact each day with the constituents you serve. These include systems administrators, business analysts, project managers, technology implementers and others: the whole range of individuals on your team. It's not uncommon in government to find teams whose skills are somewhat out of date. But it doesn't have to stay that way.

When Carolyn Lawson, joint CIO of the Oregon Health Authority and the Oregon Department of Human Services, took the helm, she met a familiar sight: "I was dealing with legacy staff, not just a legacy environment. This staff had legacy skills — not poor skills, just traditional IT skills." Rather than give up, Lawson spied an opportunity to move the organization forward.[7]

"I sent out an email to everybody — I did not care if you were a receptionist on the help desk or a senior engineer," said Lawson. "I said, 'We are going to have enterprise architecture training. If you have an opportunity to change this organization forever, who is in? If you are in, send me your résumé.'"

The response was overwhelming. She ended up with 20 participants, many of whom were far from the usual suspects. Lawson describes one woman who was so nervous she was shaking. "She could articulate why it was important to the business," Lawson said. "She did not have all of the technical knowledge but she could see she had the ability to see beyond the technology ... she was in."

Given the right leadership, the staff whose skills appear to be the most out of date might be your future social media experts or cloud computing specialists. Giving your team a chance to excel and an opportunity to transform themselves can be the most empowering activity you can undertake as a technology leader.

Taming a Paper Tsunami

Sanjeev "Sonny" Bhagowalia confronted a rough past when he assumed the CIO role in the Aloha State. Hawaii hadn't meaningfully invested in technology for decades. "Only about 5 percent of the services are online," said Bhagowalia. "Most of our systems are about 30 to 40 years old; that is the environment we are trying to transform."

To make matters worse, one prominent state data center is "about one mile away from the water and it's technically below sea level. That's not a good combination for paper or technology."[8] Only after completing a survey of the past — including meeting personally with numerous staff — did Bhagowalia craft an ambitious transformation plan for the state, which was recently recognized as the only state awarded the prestigious Federal 100 Award.

Hawaii's transformation plan "is nothing short of a full business and technology transformation," said Bhagowalia. For example, paper is processed at an astounding rate in Hawaii. Bhagowalia explained that "in one division alone we process 24 million pieces of paper [a month]. There are about 8 to 10 divisions in that department, and there are 18 departments. Linearly we cannot extrapolate, but that's a lot of paper."

Take the Department of Taxation (DoTAX), which has been operating in a paper-intensive environment for decades. "In close partnership with DoTAX, we are in the process of launching the acquisition and subsequent deployment

"I WENT TO ALL THE I IN THE (DATA CENTER) I THE TABLE AND HELP M LINE WAS WE NEEDED A TO BECOME SUCCESSF

of a tax modernization system that will change that," said Bhagowalia. The State Senate has led by example in successfully switching to electronic systems and paperless processes, and now conducts budget meetings over the Web on laptops and tablets.

However, Bhagowalia said that this is a small step forward on what will be a very long road. He is trying to initiate a policy to allow employees to accept digital signatures as long as there is two-factor authentication already in the system (e.g. ID and password). He also described a planned enterprise resource planning (ERP) system, a Top 10 enterprise transformation program. The ERP system will revolutionize seven functions in the state: budget and finance, payroll, time and attendance, human resources, asset management, acquisition management and grants management.

"With adequate funding, this ERP system will take at least five years, plus the acquisition timeframe of a minimum of six months," Bhagowalia said. "It will take a while for us to get close to paperless." But the intent — and more importantly, the plan — is in place to make meaningful progress in escaping the paper tsunami.

Extending Systems in New Directions

It's tempting to think of everything from the past as old and inadequate, but this is far from the truth. Some line-of-business systems and modules

TEXAS DEPARTMENT OF INFORMATION RESOURCES

EXECUTIVE DIRECTORS OF THE AGENCIES INVOLVED PROJECT. THERE WAS AN OPPORTUNITY TO SIT AT ME IDENTIFY WHAT WE NEEDED TO DO. THE BOTTOM A NEW SOLUTION FOR THE DATA CENTER PROJECT UL." — *Karen Robinson*

have been working properly for 40 or more years. Many systems that manage the core operations of our agencies run smoothly, are supportable, and can be maintained efficiently moving forward. They don't need to be replaced — just extended in new directions.

Florida State College at Jacksonville (FSCJ) is a great example of how past investments can still yield a return today. No one needs to adapt to new mobility and digital strategies like colleges. FSCJ has thousands of students, making it the fifth largest institution of its kind in the nation. And FSCJ serves Jacksonville, the "youngest major city in Florida," with a median population age of 35.[9]

"The key to a successful student experience is our ability to leverage their existing behaviors and platforms to our mutual advantage," said FSCJ CIO Dr. Rob Rennie. "Everything must be of the highest quality and must be mobile."

But the college faced a challenge in this respect. Most of the data and functionality that the students wanted to access from mobile devices was managed by the college's established legacy systems. The legacy systems were workhorses, and the college had made a substantial investment in their installation and support. Would the college scrap a highly functional system in order to meet the mobility needs of its students?

Fortunately, it didn't have to. Service-Oriented Architecture (SOA) enabled a Web service connection between the legacy systems and the mobile platform via SOAP/XML. The legacy investments would be optimized while being wrapped in an all-new, engaging mobile user interface layer.

The system has been launched, and the community couldn't be happier. Course enrollment and a range of other educational functions are now available at the students' fingertips. "Exceeding the students' expectations is critical," said Dr. Rennie. "The benchmark is no longer their other educational experience, it is their best experience overall — whether that be Google, Apple or the store down the street."

California's Contractors State License Board (CSLB) faced a similar challenge. CSLB also wanted to make the jump to the Web, offering new services such as checking on contractor licenses and taking contractor exams. But the board had a "mainframe-based, green-screen" system and didn't see the path to connect it to the Web.[10]

The board connected the system to its Web infrastructure via a special data gateway module, which allowed information to flow easily from the mainframe to the Web. Debbie Phelps, senior programmer and analyst supervisor at CSLB, said the project exceeded the agency's goals.

"People used to have to call us to get information, but now they just use the Web. It's particularly helpful because often, due to [the] large volume of calls, it was difficult for customers to get through on our phone system," said Phelps. "The Web component has been a resounding success." ■

TOOLS OF THE TRADE:

It takes more than a steel resolve to come to terms with the past. Here are some tools and techniques to help:

1. **Organizational leadership**
2. **Crises management**
3. **Mapping threats and vulnerabilities**
4. **Reviewing policies and procedures**
5. **Understanding the use of paper and document retention strategies**
6. **Business process improvement**
7. **Digital records management, preservation and e-discovery**
8. **Business system analysis**

“YESTERDAY IS GONE. TOMORROW HAS NOT YET COME. WE HAVE ONLY TODAY. LET US BEGIN.”

— Mother Teresa

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Leading to Master the Present

One of the toughest questions any chief technology officer faces: Scrap the current system or work with what I have? You have to look at the problem holistically by calculating the cost of completely replacing the system versus the cost of modernizing.

There is no "Hippocratic Oath" in IT like the first pledge that doctors take to "do no harm." But perhaps there should be. How do you assess existing/ongoing responsibilities? How do you make sure that change doesn't mean disruption? How do you keep that rag-tag fleet of old systems and processes running smoothly long enough to modernize them?

There isn't an abrupt transition from the past to the present, of course. We get a hold of our legacy systems, people and processes, and begin to apply new tools. As the new tools are developed and implemented, colors slowly appear in the picture that weren't there before.

Finding New IT Value

Although Sherri Hammons has only been the chief technology officer for the state of Colorado for a year and a half, she has already made great strides in bringing Colorado's legacy systems into the modern world. Hammons reports to Kristin Russell, the secretary of technology, and directly manages a wide range of enterprise transformation initiatives. Hammons' dedication is already paying off in smoother-running IT systems and planned projects to improve the lives of Colorado's citizenry.[11]

Hammons started her technological renovations by tackling the Colorado Business Management System (CBMS). CBMS had been rife with problems for several years; Colorado Gov. John Hickenlooper even singled it out in his State of the State address as a system in need of improvement. Hammons tackled the problem by first addressing one of the toughest questions any chief technology officer faces: Scrap the current system or work with what I have? She looked at the problem holistically by calculating the cost of completely replacing the system versus the cost of modernizing.

Hammons ultimately decided to update the current system, describing CBMS as "being on a modern platform but not built to succeed." Over the past year, her office has been "moving around the code so that you can actually start working with it in a more intelligent manner and a lot more nimble fashion." Thanks to these modernizing efforts, CBMS has been streamlined, ensuring that "citizens who need Medicaid are getting their benefits in a more timely fashion."

Mastering Data Management

In Georgia, Statewide Longitudinal Data System Director Kriste Elia is currently working with the Governor's Office of Student Achievement (GOSA) to change the way that technology supports teaching. She has recently launched a revolutionary master data management (MDM) initiative, which gathers and consolidates information from across educational agencies. Elia's work with GOSA has also given her insight into how legacy systems can be improved and modernized, without removing them completely.[12]

When she was first brought into GOSA, Elia found that there was limited technology for data analysis. "These were primarily laptop users; Excel was their tool of choice," she said. Elia solved this problem by working with the University System of Georgia to leverage its existing environments and base knowledge set. She was also able to draw upon some funding to build a development environment, a test environment and a production environment, and to hire a team of top-level data warehousing experts. Through these collaborations and internal developments, Elia was able to build what she refers to as the "jewel in our crown": the MDM system.

"THERE ARE STILL SO MANY OPPORTUNITIES IN PLACE TO ALLOW ORGANIZATIONS TO LEVERAGE THEIR LEGACY SYST WILLING TO STEP OUT INTO SOME NEW SPACE. YOU'VE GOT TO GET THE RIGHT PEOPLE ENGAGED AND KNOW WHERE TO THESE GREAT IDEAS." — *Kriste Elia*

As Elia explained, MDM is "a sophisticated toolset with algorithms for identifying and linking students and teachers through time." It collects 18 pieces of personally identifiable information on every individual associated with the schools, and then consolidates this information into cohesive trajectories. For example, the system can track individuals who attended a teacher-preparedness program and have now become teachers, providing information such as how well they did in their university classes, where they are teaching and how successful their students are. This creates "an environment where we can provide feedback to those teacher-preparedness programs to help them build better teachers," she said.

A system like MDM would be valuable in a variety of government contexts; for example, it would allow departments to have a more comprehensive view of services that are deployed across programs. But many departments, such as health and human services, cannot replace their existing legacy systems. Elia said that many legacy systems are too embedded into their organizations to be removed wholesale, with staff members specifically trained to work with the outdated applications. However, "there are still so many opportunities in place today that would allow organizations to leverage their legacy systems if they're willing to step out into some new space."

Elia cited the example of the Southwest Education Data Exchange (SEDE), a project that allows participating states to track, monitor and share information for K-12 exchange students who cross state lines. The system uses "indexing" technology that allows states to maintain their own legacy environments. The tool uses approved indices to identify if a specific student is from an adjoining state.

"These things are possible and available," Elia said, "but again, you've got to have the ability to get the right people engaged and know where to look to pull in these great new ideas."

Unplugging Outdated Applications

One of the most active areas in this "mastering the present" section is the collective of data center modernization, virtualization and the cloud. While this may sound familiar, today's approach to consolidation is different. Data center consolidation is really becoming an umbrella term that incorporates a set of constituent parts.

In the past, the focus of data center consolidation has been on its brick and mortar aspects. Enterprises looked askance at multiple facilities and set out to implement a "forklift" approach to combine them into one integrated facility. That is a great achievement, and it certainly cuts down on floor space, power, cooling, operations and staff costs. But it is the proverbial tip of the iceberg.

The real savings for government comes from the ability to consolidate applications, archive the data and then retire the applications that are no longer needed. Too many systems in government are maintained at great cost but only used on an infrequent basis. Oftentimes, these applications are maintained not for their features and functions, but for the data locked inside the systems. It isn't wise for a state to maintain an entire archaic HR system just because someone will log in every few months to run a report. The application needs to be retired.

To modernize the contents and not just the physical plant of their data centers, organizations need to look at their application inventory and their functional requirements. Do we really need 20 HR systems, or can the features and functionality of a single system meet our processing needs?

But once application consolidation is on the table, people begin to ask, "What will become of the data?" It is tempting to keep retired systems running purely for reporting. While this "poor man's data warehouse" may seem to be low risk, it is anything but. And it comes at a very high cost. The agency now has close to the full cost of supporting the system, with very little benefit to show for it.

To solve this problem, leading organizations are realizing that the answer is to give users access to their data in a different way, so they can actually

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retire the outdated applications once and for all. When the application itself is decommissioned, we can finally shut off the hardware, physically unplug the machine and save electricity. We can dispose of outdated equipment that is likely costing enormous fees in support agreements. We can get rid of the middleware connecting to the systems, and the associated operating systems. All of those savings represent cash that governments desperately need right now.

Those cost savings can be reinvested to accomplish a project that we actually need, which is the archiving, consolidation, reporting and analytics of our historical data in a streamlined, secure and safe repository. With a robust data warehouse and analytics infrastructure, our agencies can maintain our critical data assets while still moving forward. That's right: Unplugging outdated applications is your ticket to big data innovation.

Richard Sanchez, CIO for Los Angeles County, is one leader who is making great progress towards data center modernization. Sanchez has been with the county for over 38 years, so he has already crafted an impressive legacy. But he's far from done with innovation.[13]

Sanchez is exploring cloud technology as a way to centralize the county's services, but he isn't interested in utilizing a completely off-the-shelf cloud service from the commercial market. Instead, he wants to establish a private cloud. Right now he is trying to rally the county's agencies around the idea, but he has hopes for an even greater application: "At some point in time in the future, we may even provide that cloud to the 88 cities that are within Los Angeles County as opportunities for disaster recovery."

Sanchez has already made great strides in the area of virtualization. Recently, he spearheaded a virtualization campaign that led to a successful backup storage deal, which he estimates will save the county over $6 million within the lifespan of that agreement. The deal provides for "centralized storage as well as computer facilities with our X86 environment," Sanchez said. This centralized unit will be able to back up data with never-before-seen efficiency, and will have the capability to keep all systems running in the event of a complete power outage.

When looking to the future, Sanchez focuses strongly on centralization. "There is an opportunity where we might be able to just centralize all our resources into a single source that any county department can then leverage." Sanchez's main task is to encourage agencies with their own data centers to move into the county's centralized service. "It's run 24/7 and has all of the requirements for disaster recovery in place that many of these agencies can't afford."

Achieving Agility Through Standardization

Sometimes history really does repeat itself. The Department of Defense (DoD), through the Defense Advanced Research Projects Agency (DARPA), essentially invented the Internet with its ARPANET project. As its invention has grown and developed, it is only natural to expect that DoD would be on the forefront of Web innovation.

Henry Sienkiewicz, technical program director for the Defense Information Systems Agency (DISA) Computing Services Directorate, has launched a new rapid access computing environment (RACE) that is moving the agency quickly and seamlessly into the cloud. Agency users can simply log on, choose some options and select the infrastructure that is right for them. All of this happens online, and users can even pay via inter-agency transfer or a government purchasing card. It's that simple for a DISA program to move into the cloud, thanks to Sienkiewicz's effort.[14]

"It was a great success story," said Sienkiewicz. "I'm able to provision right

"THERE IS AN OPPORTUNITY WHERE WE MIGHT BE ABLE TO JUST CENTRALIZE ALL OUR RESOURCES INTO A SINGLE SOURCE THAT ANY COUNTY DEPARTMENT CAN THEN LEVERAGE."

— Rick Sanchez

now in 24 hours — [and] 23-plus of those hours is actually moving the money."

The key to such agility has been standardization. The agency offers standard packages on both the LAMP and Windows stacks. This approach allows a range of options but also leverages standardization to drive down cost. The flexibility also allows for incremental improvements to agency systems, according to Sienkiewicz. "By keeping it standardized underneath the covers, we're able to gradually and gracefully release and bring the customer base along with us, as opposed to forcing them to do massive migrations all at once."

With this robust foundation, DISA and the wider DoD have even set their sights further towards the horizon, envisioning a government "apps store" of shared application development resources.[15]

Obtaining Infrastructure Resources, Faster

The state of Alaska was facing challenges that might be familiar to many jurisdictions, namely that it was taking too long to deploy new applications. New systems sometimes took months — or even years — to get into production. The hardware and infrastructure resources purchased would be planned in a piecemeal fashion. Not only did this lack overall strategic coordination, it was inefficient.[16]

"We would start new projects and buy hardware, and then buy more hardware for the next project," said Corey Kos, Alaska's enterprise architect. "The biggest challenge was the time to deliver services. We had hardware which needed to be configured and stood up, but we could not get everything ready to deliver services [by the time] end users needed it."

Kos conducted thorough planning, aided by experts from industry. After his analysis, Kos determined that an advanced, fabric-based computing solution would provide the flexibility, scalability and efficiency that Alaska needed. He selected a modular, pod-based architecture that made it easy to attach additional capacity into the state's unified wide-area network. The network itself was streamlined — providing a single, advanced platform to share data and applications securely across both the data center and the rest of Alaska's enterprise.

Alaska's choice of a modular, pod-based architecture meant that additional "chunks" of data center capacity came in "pre-integrated and pre-tested" units that combined computing resources, virtualization and storage connected through a "unified fabric" to provide secure interconnection. This approach is a variant on the "data center in a box" approach that was originally called "container computing." It's the same basic concept, just in more discrete, manageable units.

The results were impressive. Kos noted that his performance goals of faster and more flexible infrastructure resources were achieved. Perhaps even better: "We are seeing significant cost savings in the hardware and data center space, due to a reduction in the number of server chassis and required cabling."[17]

The city of Avondale, Ariz., also had an aging storage system, but all of the city's core systems rested on IT and couldn't be disrupted. CIO Rob Lloyd identified that the data center was dangerously close to its power capacity: "According to the electricians, our electrical system was being tapped at 96 to 98 percent of available power, and we needed to respond to new needs." It was time to look for a new approach.[18]

"In government, a lot of times what you do is replace things as they come due, instead of taking a look at what we can do as a whole and come up with a different design," said Lloyd.[19]

Avondale turned to a modular, pod-based data center solution to provide a better foundation for the future. The pod approach brought together storage, network and computing resources into a unified whole that was easy to manage and even easier to install. The city expects to save $30,000 per year, has solved its performance challenges and has the storage it needs. In fact, the system has a

"OUR ELECTRICAL SYSTEM WAS BEING TAPPED AT 96 TO 98 PERCENT OF AVAILABLE POWER, AND WE NEEDED TO RESPOND TO NEW NEEDS." — *Rob Lloyd*

JESS LEGASPI

powerful data de-duplication capability that freed an additional 40 percent of its storage space. The city dropped from 96 percent of available power being used to a much cooler 45 percent.[20]

Avondale's partnering strategy was key to its success. City leaders recruited private sector partners to help them identify an architecture that would work for them. "What we discovered was that vendors are starting to work together [to] co-support a solution ... that perfectly fit into what we hoped for," said Lloyd. Not only were their implementation partners technologically savvy, but hard working as well. "During implementation, [our partner] was answerable," said Lloyd. "I was emailing [them] at 10 o'clock, 11 o'clock and [they] would respond."[21]

Avondale was able to purchase combined hardware and services in a single purchase order via a contract available through the U.S. Communities cooperative.[22] This simplified the procurement process, but the benefits were greater than time-to-implementation alone. "In this day and age, you are seeing more value rendered by those companies that can partner well together rather than those who just focus on their [own] solution and their [own] products," said Lloyd.[23]

Keeping Data Intact Through the Cloud

As the IT director of the East Bay Regional Park District, Jim Tallerico oversees the deployment and management of IT-related services for the district. One particular challenge Tallerico has faced is how to provide storage for the district's data. The East Bay area is prone to earthquakes and most of the district's remote facilities are not suitable as disaster recovery sites. Tallerico said that although the data stored internally is not considered critical, "We do want to preserve it in the event our central data center was to experience a major catastrophe."[24]

AVONDALE WAS ABLE TO PURCHASE COMBINED HARDWARE AND SERVICES IN A SINGLE PURCHASE ORDER VIA A CONTRACT AVAILABLE THROUGH THE U.S. COMMUNITIES COOPERATIVE.

Tallerico's solution has been to invest in cloud technology, which offers a cost-effective way to archive data without the need for infrastructure. The project is currently under development, with the district backing up data from multiple origin sites to both in-house and cloud storage sites. Tallerico said that the biggest challenge so far has been bandwidth: "Pushing a large amount of data to the cloud consumes a great deal of resources over our Internet connection." Fortunately, the agency has been able to minimize performance issues by tightly scheduling online usage.

In fact, many cloud innovators don't realize — as Tallerico has — that clouds and network modernization must go hand in hand. Without a robust network, the cloud just doesn't work at production scale.

Tallerico noted that many government agencies are still wary of cloud technology because of concerns over the privacy and security of the data, but he said that will soon change: "As the applications mature and become more cost effective, I expect you'll see more government agencies looking at cloud solutions in the future."

He also foresees the greater use of hosting sites. Tallerico's agency began adopting the hosting model for core applications about six years ago. "This takes the burden off of the IT department of dealing with disaster recovery in terms of building out secondary data centers — which are very expensive to maintain," Tallerico said.

In addition to investing in cost-effective technological solutions, Tallerico has also established annual funding for hardware and software replenishments. When considering whether to update or replace legacy systems, Tallerico said there are several important questions: "Are the apps/processes functional in the current environment? Are they running on current technology platforms? What is the cost to maintain them?" This practical approach has eliminated any surprise costs and allows the agency's budget to remain flat year to year. ■

TOOLS OF THE TRADE:

New tools and capabilities can come into play in the present as we re-point our organizations to their future goals:

1. **Data warehouses and data analytics**
2. **Shared services**
3. **Virtualization**
4. **Data center consolidation**
5. **Unified communications**
6. **Identity and access management**
7. **Business continuity and disaster protection**

Building for the Future

We need to ask ourselves — are we innovating just for the sake of novelty, or will our work stand the test of time?

As in the transition from the past to the present, the present and future are on a continuum. We slowly build the future, and point our organizations in a wise and prudent direction. Once the course is set, we can consider our legacy.

Unlike Roman emperors, not even the greatest IT leaders are commemorated by statues or with their likeness stamped on coins. But if you think past IT leaders aren't lauded or derided, think again. We need to ask ourselves — are we innovating just for the sake of novelty, or will our work really stand the test of time? Will we be seen as forward-thinking innovators who brought our organizations into the modern age? What will remain from our efforts when our successors take the reins?

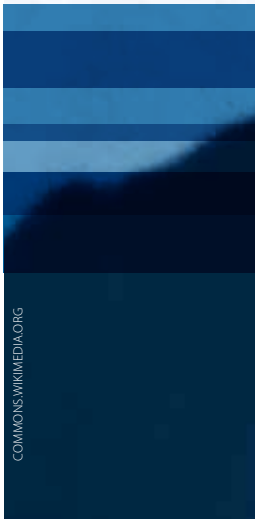
Much of this discussion depends on the technologies and platforms of the future. We have focused here on innovation that has real value in terms of improved service, lower cost or better citizen engagement. At the same time, the leaders we profiled have explicitly avoided the *flash-in-the-pan* school of IT innovation.

Preparing for the Threat of Cyber War

Cyber security is a great topic for a writer — there is always something new to say about it as the pace of innovation continues to accelerate. Karen Robinson, the Texas State CIO we introduced earlier, puts cyber security at the top of her agenda.

"We're seeing upwards of 110 million attacks on the network a month. It only takes one to get in. So, needless to say, I've really stood up a good team to help run the Security Operation Center."

Following the 2011 creation of a council on cyber security,[25] Robinson gathered experts from higher education, state agencies, the military and elsewhere to assess the state's cyber security infrastructure and recommend best practices to leadership. She has also partnered with a third-party company to conduct voluntary security assessments for other state agencies. Last year, roughly 14 such assessments were completed, which are comprehensive: "What do you have in place? Let's look for gaps, trends and let's figure out what we need to do going forward."



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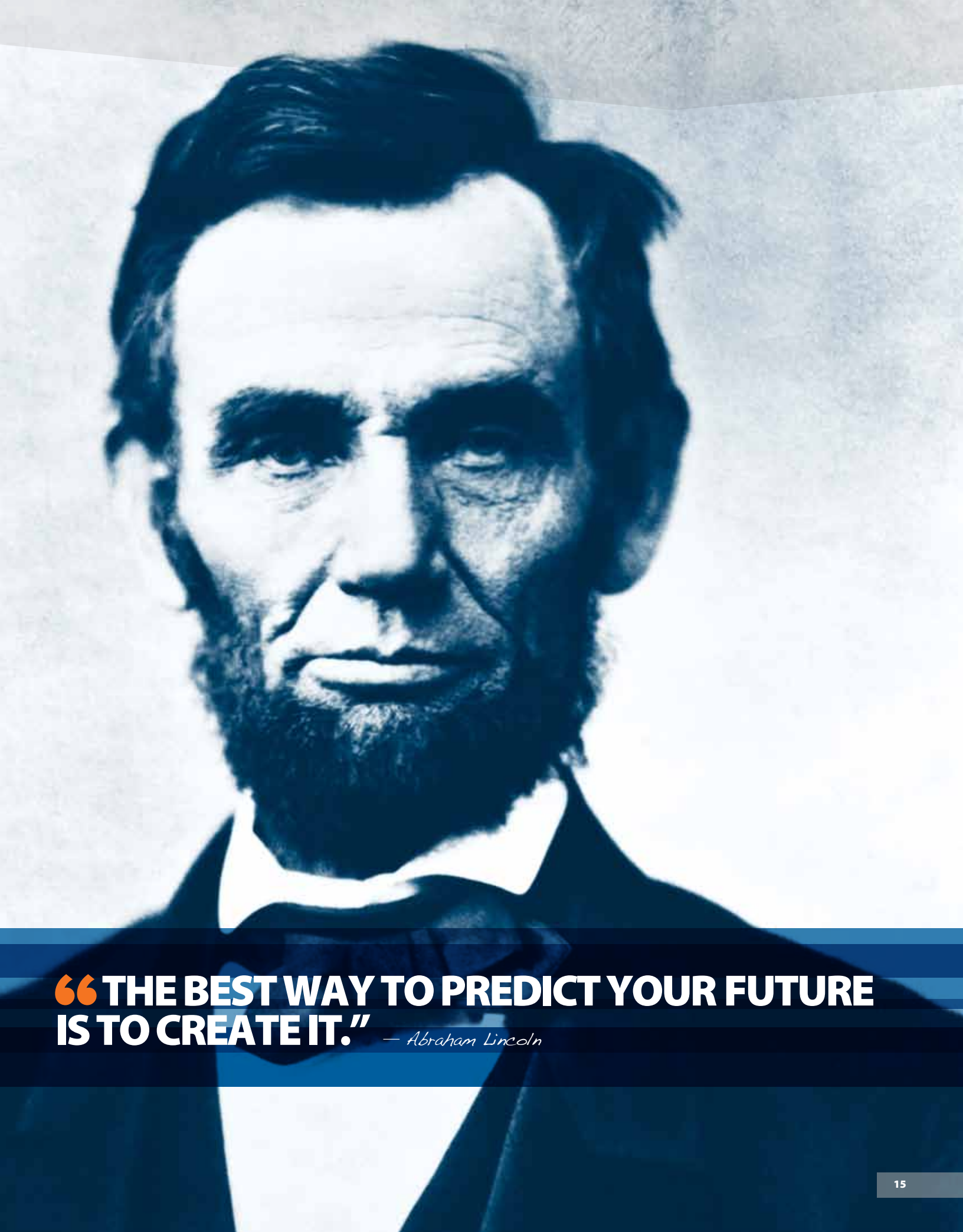

“THE BEST WAY TO PREDICT YOUR FUTURE IS TO CREATE IT.” — Abraham Lincoln

"LOCAL GOVERNMENT IN GENERAL NEEDS TO GET SOME RELIGION AROUND THE WHOLE CYBER SECURITY ISSUE BECAUSE MOST LOCAL GOVERNMENTS HAVE IT STAFF OF JUST A FEW PEOPLE … AND SO NOBODY HAS ALLOCATED RESOURCES TO DO ANYTHING AROUND INFORMATION SECURITY." — *Mike Hamilton*

Moving forward, Robinson plans to continue the security assessments with state agencies (saving them "a lot of money" in the process), while upgrading and prioritizing state security policies, studying identity management and establishing standards. She'll also be looking to add more security staff to the Department of Information Resources (DIR), a task made more feasible by the fact that, under Robinson, the DIR has reduced its operating budget by 47 percent and its number of full-time employees by 17 percent.[26]

We may never be able to fully protect our users from every potential security threat, but we can strive to be the very best. That's the spirit of the Center for Digital Government's Cybersecurity Leadership and Innovation Awards. The program sets out to recognize the leaders who are creating a legacy of cyber security and breach prevention.[27]

Last year, Texas took top honors for its work in the state category. Texas has launched a suite of Security Event and Threat Analysis (SETA) services that are also deployed in a cloud model. The platform enables state agencies to conduct 24/7 security monitoring, as well as respond to security incident alerts. Past incidents are archived, and agency-tailored response plans are part of the picture.

New York City led the list in the awards' city category, having built an "information security cloud" that has realized a cost savings of $18 million. Dan Srebnick, CISO for the city, said that the cloud was fully operational for the 43 agencies within scope. The security cloud provides direct visibility into 73,000 endpoints, dramatically improving the city's security posture. Srebnick noted that "The world is engaged in a global cyber war … and … all of government, including state and local, are targets."

Seattle won a special award for collaboration in the field of security for a project called Public Regional Information Security Event Management (PRISEM). The system was created through a public-private partnership that brought state and local government together with universities and industry players. The system provides an early-warning capability by aggregating and analyzing incident information in real time. While many jurisdictions jealously guard their own security incident data, Seattle led the effort to show that there is indeed safety in numbers.

Mike Hamilton, CISO for Seattle, said that much more work remains. Hamilton issued this stark warning to his colleagues: "Local government in general needs to get some religion around the whole cyber security issue because most local governments have IT staff of just a few people … and so nobody has allocated resources to do anything around information security." With the shortage of staff noted by Hamilton, public-private collaboration will be all the more important as time goes on.

Expanding Health Care Access

In her time so far as joint-CIO of both the Oregon Health Authority and the Department of Human Services, Carolyn Lawson has successfully negotiated the needs of both departments and emerged as a strong force for technological innovation and business transformation. She has spearheaded successful modernization efforts and built a health insurance exchange (HIX).

Lawson said that her dual role allows her the opportunity to offer citizens more unified services. She asks herself and her team, "How do we provide a unified approach to all health and human services technology delivery?" The reality is that many people served by one agency are also served by the other, so there is an opportunity for collaboration.

HOWEVER ROBUST THE LONG-TERM VISION … FORGET THEIR FUNDAMENTALS. "HOW CAN … PUT IN A NEW $10-MILLION ERP SYSTEM FOR … THE CIO BUT YOU CAN'T FIX MY PC. HOW TH… WE NEED TO BUILD THEIR TRUST." — *Mujib Lodhi*

Lawson described a situation in which a person might come to the human services department for a food stamp form but might also need medical care, which traditionally would be taken care of by the Oregon Health Authority. Lawson explained, "It makes no sense to say, 'Okay, this is all that I can do for you. The Health Authority is 10 blocks down the street.'" Instead of this old, disjointed approach, Lawson emphasized the need for a unified approach for health and human services.

Lawson began this enormous undertaking with two concurrent projects in 2011. The first was the transformation of the Department of Human Services, which included the development of a Web center, increased focus on case management and the modernization of the human service systems.

While evaluating this process, the Oregon Health Authority asked if the platform could be used to develop an insurance exchange. The evaluation found two vendors on the human services side that could be used to build an insurance exchange. But Lawson was now faced with a new set of difficulties. Oregon was an early innovator, but she didn't have the luxury of time — the state needed to deliver the exchange in 2 ½ years. Lawson was tasked with building two major applications on a very short deadline. The results have been great, and Oregon is well positioned to be a national leader in this critical space.

Another intersection of technology and health care is the arena of telemedicine. Many of the early successes in telemedicine are coming from prison systems, where access is limited and the movement of health practitioners, health technology and medical treatments is cumbersome and restricted. California's problems in this area were so severe that a federal lawsuit was filed arguing that the lack of access to medical care violated the inmates' constitutional rights. Important public safety issues were also in play, since 10,000 prisoners per month would be released from incarceration into California communities in order to receive medical care. Bringing the inmates to doctors — alongside the law-abiding citizens of California — was an unpleasant proposition.[28]

California found a new solution: *telemedicine*. By leveraging telemedicine, inmates could be given access to a wide range of specialists via a telepresence solution that mimicked an in-person visit. This provided better care for inmates, ensured safety for law-abiding communities and lowered costs for the state.

"We're getting access to care to the patients that need it, and decreasing safety issues; it's a win-win situation for patients and physicians," said Dr. Michael Arca, chief physician at the California Correctional Health Care Services agency.

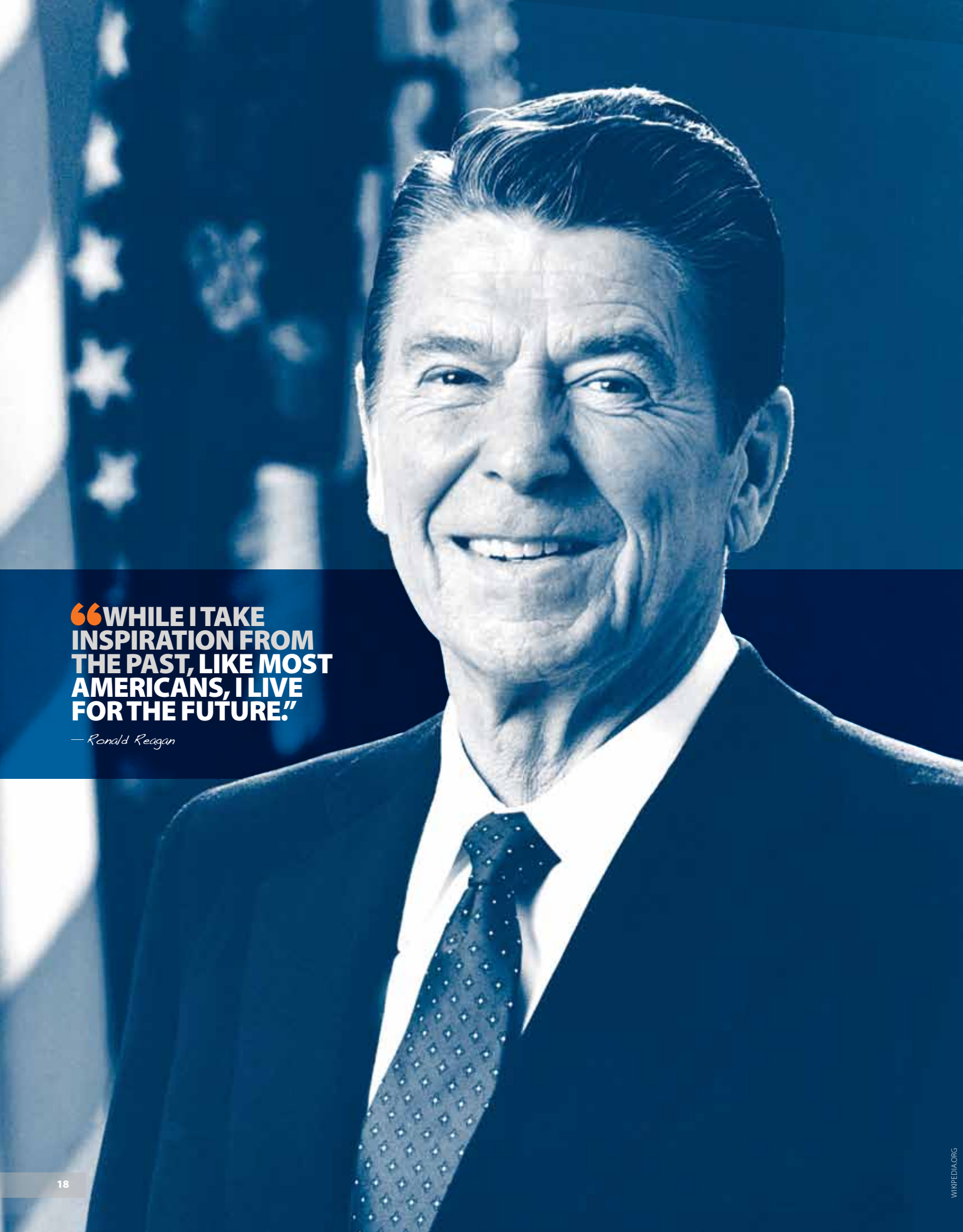
Remembering the Fundamentals

Many CIOs aspire to be business focused, but Mujib Lodhi, CIO for the Washington Suburban Sanitary Commission (WSSC), takes it to a whole other level: "As a CIO today, I have to understand the business very well. As a consultant to the organization, I have to understand the business and what business we are in. Not just providing them a technology solution, but providing them a business solution."[29]

Indeed, CIOs increasingly need to understand not only how to fix an organization's computers, but also to grasp the finances, operations and goals of the organization. These hard facts grow increasingly important as more data-driven decisions enter the workplace. CIOs are no longer solely "techies."

WSSC serves as an extraordinary example of how IT can contribute to an organization's top-level goals. As one of the nation's top water and wastewater utilities, serving 1.8 million customers, WSSC must remain financially solvent and maintain an ever-expanding critical infrastructure. When Lodhi thinks about ways to improve the organization, he always traces his thought process back to these fundamental goals.

I IS, IT'S EQUALLY IMPORTANT THAT CIOS NEVER N I WALK INTO YOUR OFFICE AND SAY I WANT TO R YOU, IF YOU LOOK AT ME AND SAY, 'YOU'RE IE HECK CAN YOU FIX A $10-MILLION SYSTEM?'



“WHILE I TAKE INSPIRATION FROM THE PAST, LIKE MOST AMERICANS, I LIVE FOR THE FUTURE.”

— Ronald Reagan

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WHEN YOU DON'T HAVE THE MEANS TO DO SOMETHING YOURSELF, LEARN TO SHARE. AS IN, LEVERAGE OPEN SOURCE TECHNOLOGY. "OPEN SOURCE SOFTWARE WORKS BECAUSE IT ENABLES PEOPLE AROUND THE WORLD TO SHARE THEIR CONTRIBUTIONS WITH EACH OTHER."

— Matthew Burton

Once he has identified his fundamental goals, Lodhi hones in on the specifics. For example, capital improvement for infrastructure is a staggeringly complicated business problem for WSSC — so it launched a mobile app to allow customers to instantly submit geo-tagged photos of problem areas — the first of its kind in the nation.

Lodhi's ultimate vision is to help WSSC transform into a "real-time utility" that utilizes data analysis at every step in its business processes and decision-making. In this future, when a customer calls WSSC, a work order will immediately be created and the work order system will determine the optimum routing and technician to dispatch in order to cut down driving time, gas and other costs. The enterprise will have real-time communication with the customer, and provide a faster response to the customer's needs. When the customer's issues are resolved, WSSC's field representatives will contact headquarters directly to close out the case. The mobility of water and wastewater technicians will enable these field workers to remain in the field and be dispatched with maximum efficiency.

However robust the long-term vision is, Lodhi knows that it is equally important that CIOs never forget their fundamentals. "As a CIO, I cannot ignore that," Lodhi said, "because how can I walk into your office and say I want to put in a new $10-million ERP system for you, if you look at me and say, 'You're the CIO but you can't fix my PC. How the heck can you fix a $10-million system?' We need to build their trust."[30]

Learning to Share

Every CIO today — public sector or not — knows that good programmers are hard to find. There is simply a skills shortage. If you live in a technology hub like Austin, Texas, or Silicon Valley, then you face stiff competition from startups and private enterprise for development talent. If you live in a remote area, there may not even be much of an IT workforce for you to tap. While commercial off-the-shelf software can serve a variety of needs, government agencies still need custom code and custom apps. Much of what we do is particular to us, or particular to our agency, or particular to our specific environment. Commercial software vendors usually like to sell more than 50 copies of a product when they build it, so developing packaged apps for state governments can have limited competition.

How do government agencies — cities, counties, school districts, state agencies and even federal partners — get their work done despite the dearth of programming talent? The answer might be what we all do when there isn't enough of something to go around: *We learn to share.*

Matthew Burton is the deputy CIO at the federal Consumer Financial Protection Bureau (CFPB). As someone "born in the digital era," he is keen on rethinking the established business practices of his colleagues. Burton is an advocate of sharing the programming load among agencies, and it might be just what government needs to meet the challenge of the IT brain drain previously noted. He has two approaches. One is familiar, which is to leverage open source technologies where possible.

According to Burton, "Open source software works because it enables people from around the world to share their contributions with each other. The CFPB has benefited tremendously from other people's efforts."[31]

But that isn't enough for Burton. He charges ahead to not only make his agency a consumer of open source software, but a producer of it as well. "When we build our own software or contract with a third party to build it for us, we will share the code with the public at no charge," said Burton. Of course, "exceptions will be made when source code exposes sensitive details that would put the bureau at risk for security breaches." Burton memorialized the concept in a formal policy, posted it on his agency website and has successfully used it as an operational philosophy ever since. If your department has similar code or needs, you may want to check out Burton's GitHub account to start the sharing process.[32]

Another great example of cross-boundary collaboration comes from Colorado. Sherri Hammons is working on moving government systems to Software-as-a-Service (SaaS) — utilizing the cloud and a central hosting site. Wyoming, Colorado, Arizona and North Dakota have come

together to devise an unemployment insurance SaaS model that can be used by all 50 states. This is a significant improvement on the original model, in which the federal government subsidizes a traditional system for each individual state with an expensive upfront cost. Since technology changes so rapidly, these large software purchases quickly become obsolete.

Hammons describes how this has affected unemployment insurance: "We have a 20-year-old unemployment insurance module that is on a mainframe and nobody can really support it." But SaaS offers a solution to this outdated technology: "The upgrades are built in and it becomes an operating expense as opposed to a capital expense." The four-state consortium currently has a request for proposal (RFP) for vendors to create the unemployment insurance SaaS model.

Meeting Networking Needs

There is a great deal of work to be done to position governments to meet the networking and connection needs of an increasingly digital citizenry. In Texas, the TEX-AN NG program is a multi-vendor telecommunications partnership with the state. In a recent contract update and modernization, Texas was able to achieve even higher value for its citizens.

State CIO Karen Robinson noted: "With the new multi-vendor model, we are seeing upwards of 40 percent savings each month — approximately $1.5 million annually." Along with the savings, Texas obtained a whole host of new services and a more modern network infrastructure.

As the CIO of the city of Las Vegas, Joe Marcella also has powerful ideas about how IT developers should meet the needs of their increasingly digital communities. Las Vegas recently attracted online retail powerhouse Zappos to its downtown area, bringing 3,000 new high-tech "digital natives" to town. Marcella believes that technological development should have a strong business focus and take into account the specific needs of citizens. This approach has paid off for him: By collaborating with citizens and continuously seeking solutions to unaddressed problems, he has been able to offer targeted, innovative solutions in his department and the community at large.[33]

CIOS CAN NO LONGER JUST PROVIDE A TECHNOLOGY SOLUTION. THEY NEED TO BE ABLE TO PROVIDE A BUSINESS SOLUTION.

One such networked project that Marcella cited is the successful launch of the multi-jurisdictional business license in Southern Nevada. Last year, the jurisdictions of Las Vegas, Henderson, North Las Vegas and Clark County worked with state legislatures to pass a bill that called for the development of a unified contractors' business license across all four jurisdictions. Now, instead of having to obtain a business license with each organization, contractors "can go to any one of the four [jurisdictions] and the business licence is automatically populated," said Marcella.

This dedication to community informs Marcella's approach to IT development. He values a mobile workforce that provides a direct connection with the residents: "I've got citizens out there [with whom] I can easily have a conversation about crowd sourcing or problem resolution or getting data." Marcella hires "super-users" who are both technologically savvy and business savvy, so that his team can actively discover problems in the community that need to be addressed.

Marcella asks, "Why are we always sitting back, always waiting for someone else to have a problem before we go out there and solve it for them?" He believes that this sort of one-way relationship between the community and IT developers is ultimately detrimental to both.

Marcella has deployed this practical and innovative approach while updating the technological systems in city hall. He has developed an integrated communication system that allows those in city hall to make phone calls while simultaneously videoconferencing. He believes that such multi-technological convergence will revolutionize customer relationship management (CRM) in all government departments. He gives the example of the police department, where integrated technologies would allow police officers to get "the kind of information that's necessary when in pursuit."

The South Carolina Department of Probation, Parole, and Pardon Services (SCDPPPS) is also a networked innovator. The department had a problem that is not unique in the judicial field: Field workers like parole officers are highly mobile, and need to be productive from any one of 46 courtrooms statewide. They spend upwards of 50 percent of their time out of the office, and can't be slowed down by confusing or nonexistent wireless networks.[34]

The agency needed a way to make it easy for their field workers to get secure access to their network, while also providing convenient guest access. It needed a network that could rapidly

scale up and could be added to and modified when needed. The agency also needed centralized management capabilities that would allow it to keep track of the whole system.[35]

You might think that the last word has been written on in-building Wi-Fi, but anyone who has been frustrated by coverage gaps, difficulty connecting or complex Wi-Fi management knows that is far from the case. Many of our Wi-Fi networks are a mix of old and new technology — some of which doesn't play well with others. In historic buildings and government offices, we can't afford to drill new holes and pull wires to solve the problem. So we need a better way to manage wireless.[36]

South Carolina found a solution that removed the need for the wireless controller — usually a bottleneck in the process. Typically, Wi-Fi network functions are shared between a controller and an access point. This originally was intended to solve maintenance and manageability challenges, but now the controller itself has become a bottleneck: As organizations upgrade to the 802.11n standard, the controllers just can't keep up. As a result, the cost of wireless networks is rising, even as their reliability is plummeting.[37]

South Carolina moved to a distributed, controller-less architecture that solved the problem. David O'Berry, director of IT, Systems and Services at SCDPPPS, said, "I appreciated the vision of how the access points functioned, even when they were disconnected. Most other [access points] got pretty dumb when they lost connectivity with the controller."[38] The solution gave South Carolina all of the benefits of Wi-Fi, including security and access-control protection, in a more economically cost-effective solution.[39]

The Iowa Judicial Branch took a similar path, also deploying a controller-less network for its 99 courthouse facilities. The network was easy to set up and manage, even though the agency had a small IT team. The approach also helped navigate the special challenges that old buildings can pose for an access-point layout.[40] Management of the devices is handled via the cloud, which provides other benefits as well.[41]

"There has been a few places where the local person thought we would need four access points in order to adequately cover everything, and we've been able to get it done with two or three," said Sally Thompson, infrastructure administrator for the Iowa Court Information Systems. Coverage is excellent, and the court system is well positioned to support future network growth.[42]

No current discussion of the future can ignore the topic of mobile devices and the BYOD movement. A recent *Government Technology* survey noted that 61 percent of state and local entities either had a BYOD policy already or were busily crafting one.[43] One of the biggest challenges in establishing such guidelines is that government agencies are held to a higher standard in terms of security and privacy: We can't just let any device plug into any old network. As wireless becomes the preferred mode of connection to government networks (and many devices lack an Ethernet port entirely), the challenges for managing how these devices connect to wireless networks are mounting.[44]

IT managers need a platform to manage how — and which — devices are connecting to the network. Some types of devices won't be allowed to connect at all, but many will. Not all devices will be able to access unlimited bandwidth, especially when connected on guest access. Network administrators are forced to plan for uncertain network demand from uncertain devices — all during equally uncertain economic times.[45]

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— Sherri Hammons

Large private sector organizations like airlines, energy companies and retailers are deploying a coordinated approach to managing this aspect of their wireless networks. This helps ensure that consistent policies are enforced for bandwidth usage, security, access control and more. Government, we expect, will soon be following suit.[46]

Gail Roper took over as CIO for the city of Raleigh in 2006, and found a city that had some major legacy problems. Technology was an internal affair, and it didn't play a role in the community. Roper set out to change that. Convention center traffic was down, and the Fayetteville Street mall was a ghost town. To make matters worse, lower-income constituents were being left out of the digital tsunami that was powering economic growth elsewhere.[47]

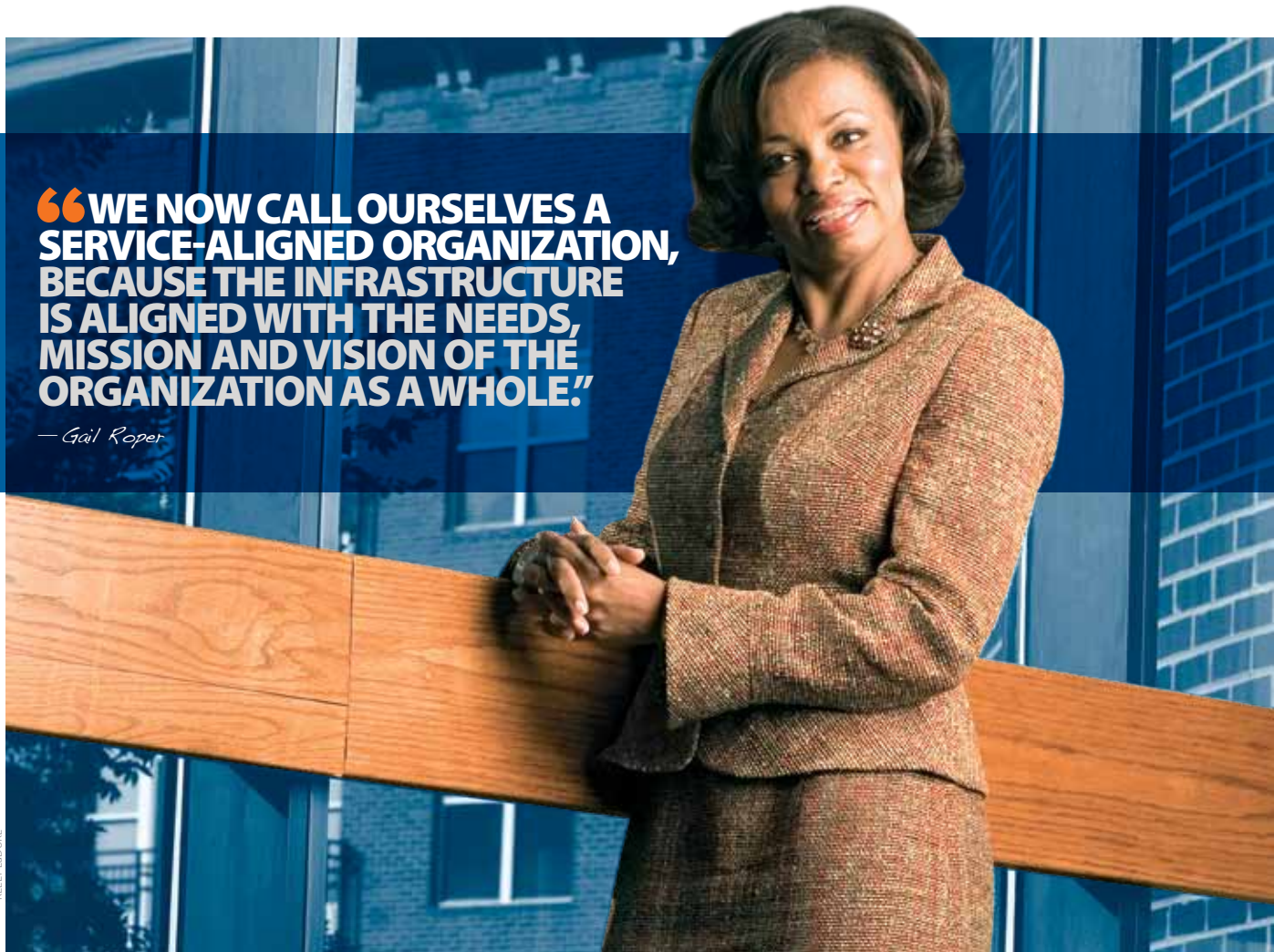
Roper decided to upgrade all of the city's technology platforms in a way that looked outward and not just inward. Roper deployed an arsenal of powerful technology: wireless mesh, unified computing, VoIP, video and more. The result was high-speed wireless at the convention center, free Wi-Fi throughout the downtown area and a powerful asset for downtown Raleigh's rebirth. Raleigh even topped the *Forbes* list of America's most wired cities in 2006.[48]

Roper defines her success — and the contribution to her legacy — this way: "We now call ourselves a service-aligned organization, because the infrastructure is aligned with the needs, mission and vision of the organization as a whole."[49]

Powering People on the Move

Technology executives like David Heck, deputy director of Finance and Technology and CTO for the city of Tempe, Ariz., are confronted with a number of legacies the moment they take on their roles. In Tempe there is a demand for faster information and self-service opportunities. "[Citizens] want to have access to the city services online from basically anywhere," said Heck. "They don't want to [have to] know the structure of government in order to find information or get help."[50]

To meet this demand, Tempe has made certain services, such as program registration and bill payment, accessible online. Tempe has also initiated a citizen-relations management desk and mobile app called Tempe311. Citizens can call into Tempe311, access it



KELLY LaDUKE

> **“THAT IS THE KIND OF INVESTMENT WE WANT TO MAKE. SOMETHING THAT IS LIKELY TO HAVE A LIFE BEYOND THE INITIAL DEVELOPMENT EFFORT.”**
>
> — Adrian Gonzalez

through the Web or use mobile devices to report areas for community improvement. “We’ve had great success so far,” Heck said of Tempe311. “Although it’s just recently been released, we’re seeing a high usage of the service.”

Heck has also successfully developed a relationship with Arizona State University (ASU) to support the needs of the community. For the past 18 months, Heck has been working with ASU to establish a Gig.U partnership in Tempe. Gig.U is a broad-based collaboration of the largest research universities and their communities from across the United States. Heck described the initiative as a “banding together, putting up funding for research, and gathering information about companies that would be interested in coming in and establishing the gigabit networks needed in a research community.”

Gig.U seeks to help its member communities establish an incubator for innovation and collaboration by ensuring that every home in the community has access to a gigabit-speed (or higher) connection. The concept is part of a larger strategy for economic development for the city. Heck wants to improve the future of his community by establishing infrastructure that will attract successful industry. As Heck explained, he wants to “make Tempe attractive to do business in.”

Heck’s focus on the future also informs the kinds of technologies he chooses to develop in his own department. Here he has sought to establish “a virtual environment, so that we’re not strapped to wires or specific hardware anymore.” This forward-thinking approach has led to several innovations, such as wireless communications in all city buildings and employee desktops that are contained on a server, rather than a desk. This allows for greater flexibility and availability. As Heck explained, “When I’m not in my office, be it at home, in the field or out of town, I can get to my virtual work environment, using a Web client or mobile app.” Heck plans to continue to manage the demand of “anywhere access” by investing in innovative solutions, such as device-agnostic services and mobile-enabled technology.

A few states over, in California, at San Diego County’s Office of Emergency Services, Technology Manager Adrian Gonzalez has helped revolutionize his county’s emergency assistance technologies. He played a large part in creating San Diego’s emergency preparedness website, “ReadySanDiego,” which offers extensive information on how to plan and prepare for disasters. He also described himself as “a coordinator and a visionary” for the county’s disaster information mobile app. These technologies have transformed the way San Diego County responds to emergencies, and established Gonzalez as a premier technological innovator.[51]

Gonzalez first embarked on the ReadySanDiego project when the Office of Emergency Services realized that it needed to revamp the website. With the increase of technology in the home, more people were gaining access to the Internet, and so the website needed to

TOOLS OF THE TRADE:

The future is where it gets interesting. Here are some emerging tools, and some that change so fast as to place them in the future category:

1. **Big data analytics (descriptive, predictive, prescriptive)**
2. **Data fusion**
3. **Enterprise architecture**
4. **Managed services**
5. **Next-generation networks**
6. **Telework and telemedicine**
7. **Social software and social media**
8. **Mobile computing**
9. **Cross-boundary collaboration**

be able to handle higher-volume traffic. This had become especially evident during the 2007 wildfires which swept across Southern California, claiming nine lives. Gonzalez explained that he and his team "realized that we couldn't just put a new wrapper on an old Web page and expect it to satisfy our new needs." Instead, they invested in cloud technologies, which allowed the site to handle higher-volume traffic and offer new capabilities for self service.

After modernizing the website, Gonzalez shifted his sights to the mobile space. Mobile technologies were starting to take off around this time, and Gonzalez understood his team needed to "respond to county government leadership and a very obvious need and expectation now from the public." Their solution was the mobile app, which provides government-to-citizen information on upcoming and ongoing disasters. Gonzalez said that the app was "able to meet our expectations, the elected officials' plus the operating departments', very satisfactorily. We were able to leverage our initial cloud investment and expand functionality into the mobile space, while keeping our business operations simple." Such a successful innovation is a great feat in government, where legacy systems often stay in place for decades.

Gonzalez has often encountered the longevity of legacy systems. He described a time when his coworkers invited him to a retirement party: "I said, 'Well, what's it for?' [They replied,] 'We're retiring the system you developed 25 years ago.'" However, he bumped into someone recently who was still using the old system on a daily basis. "The county invests money in your systems," Gonzalez said, and "they tend to hold onto them forever." Gonzalez said this governmental inertia informs how he picks his technological solutions: "Who knows what devices will come along on the mobile side in the future for this particular solution. We have to make sure that technologies that we are going to invest in are likely to have a life beyond the next couple of years."

Gonzalez applied this philosophy when developing San Diego County's mobile app. He and his team selected the Mobile Enterprise Application Protocol (MEAP) platform for building their app, because the platform had established itself as a high-quality product with staying power.

"WHY ARE WE ALWAYS SITTING BACK, ALWAYS WAITING FOR SOMEONE ELSE TO HAVE A PROBLEM BEFORE WE GO OUT AND SOLVE IT FOR THEM?" — Joe Marcella

"That's the kind of investment we want to make," Gonzalez said, "something that is likely to have a life beyond the initial development effort." In the past, most developers built their own solutions instead of relying on platforms, but Gonzalez describes the benefits of using a platform: "[With self-made solutions] you tend to get stagnated or locked into solutions that may or may not grow with you. By going to platforms, somebody else is dealing with the plumbing and the ability to integrate to other, newer features and technologies." This allows Gonzalez and his team to be more flexible in responding to changes in technology or business.

Moving to High-Performance Computing

Everyone is talking about how big data is going to rule the future. And no one outside of defense and the federal government has big data challenges like research universities. Researchers, by their very nature, are in the data-gathering and data-analysis business. New devices, sensors and equipment are generating exponentially more data than ever before. The Large Hadron Collider at CERN, for example, generates 15 petabytes of data a year. That amounts to 15 million gigabytes. It doesn't only need to be archived, but it needs to be analyzed as well.[52]

The challenge of big data is a three-dimensional expansion in terms of volume, speed and complexity.[53] First, let's take complexity. Years ago, data elements might have been lonely numerical readouts from a remote sensor device. But now they can be images, video, structured information, objects with internal links and even data with metadata. This increase in data model complexity is one factor driving the big data change.

Then there is volume. Research teams — like government program managers — rarely collect data that they don't want to keep. So the gigabytes become terabytes that become petabytes. Pretty soon, your institution or agency has amassed information on an epic scale. Sometimes, older information can be deleted to save space. But in the research context, that is rarely advisable.

The third "axis" of big data is speed. And when we say speed, we don't just mean the speed of capture and storage. Data must be stored quickly, to be sure. But it also needs to be read and edited quickly to support the pace of analysis and innovation.

The answer to this challenge for research institutions has been to move

into the world of high-performance computing, specifically in the storage arena. New devices are needed that can handle the complexity, volume and speed of today's data capture and analysis. These high-performance architectures aren't just bigger — they are different. And the difference is what reduces costs and improves staff productivity.

If you think your data needs are slight because you are a smaller research institution or a regular government agency, think again. Industry experts expect that the pace of your data needs will increase dramatically in the near future. If you were storing 100 terabytes of data in 2010, you can expect to need 11 times as much storage space in 2016, which would be 1.1 petabytes. By 2020, it would be 58 times greater. So sooner or later, we will all be facing the high-performance storage challenge.

No discussion about research, big data and high-performance storage would be complete without mentioning the need for data security, privacy and strict adherence to data retention policies. Too often, researchers dump data together without regard to the personally identifiable aspects of it. This opens the organization up to great risk.

It has long been said that the so-called "insider threat," i.e., the risk of data breach by employees, contractors or those who otherwise hold some form of legitimate access, is the greatest danger to data security. Merely encrypting data in transit to thwart hackers isn't enough. We need to be able to mask data at rest in systems to protect it from the internal threat.

"Data masking" means enforcing robust data access protocols at the most fundamental levels. It happens at the source, rather than encrypting merely at the time of network transmission. Data masking is intended to stop even a rogue database administrator from writing a SQL statement operating directly against a database. Even if he or she accesses the source directly, this type of data masking can prevent unauthorized exposure.

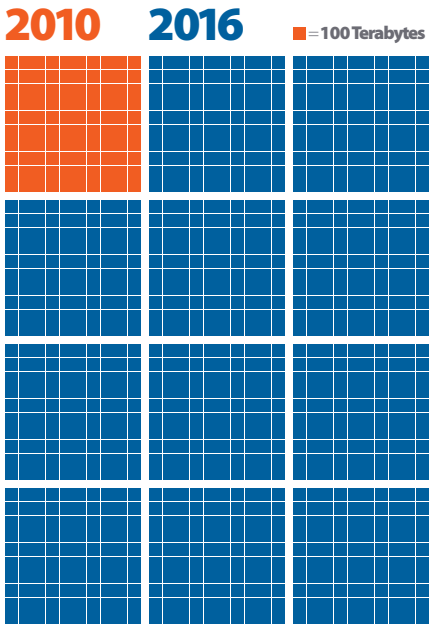
Overcoming Procurement Barriers

All of these reforms are dead in the water unless we address business processes themselves. And, of course, one of the most frustrating for CIOs is the procurement process. Let's face it: Government procurement rules weren't originally written to purchase technology goods and services.

In most states and localities, the procurement regulations that govern IT purchases were written before software, computer terminals and Software-as-a-Service (SaaS) applications were contemplated. These rules have become out of step with the times, but procurement officers are bound to follow them to the letter — or else. No one, save the legislators who can change the rules — seems to have much choice in the matter.

As a result, sometimes people involved in the process become more focused on procedural compliance than on the bottom-line task of getting the best technology at the best price. But all of that is starting to change, and CIOs are at the forefront of the transition. Many leaders have created a dialogue between themselves and the procurement officers in their organization to understand how rules can be reformed and modernized. In the last Department of Defense (DoD) appropriations bill, for example, Congress directed the DoD's CIO to identify "alternative acquisition strategies" for IT that would allow for:[54]

a. early and continual involvement of the user;
b. multiple, rapidly executed increments or releases of capability;
c. early, successive prototyping to



IF YOU THINK YOUR DATA NEEDS ARE SMALL BECAUSE YOU ARE A REGULAR GOVERNMENT AGENCY, THINK AGAIN. IF YOU WERE STORING 100 TERABYTES OF DATA IN 2010, YOU CAN EXPECT TO NEED 11 TIMES AS MUCH STORAGE SPACE IN 2016.

support an evolutionary approach; and d. a modular, open-systems approach.

This strategy of breaking mega-projects up into more manageable chunks has a number of historical precedents, and some good sense behind it. As it picks up steam, we may see a higher rate of IT project success at all levels of government.

If you read "modular, open systems" above and thought of "open source," you aren't alone. DoD has overcome barriers to the procurement of open source technologies in an effort to drive down costs while improving overall IT performance. Back in 2009, former DoD CIO David Wennergren issued a new policy providing "Clarifying Guidance Regarding Open Source Software." The memorandum noted that DoD needed to deploy software faster than ever, and that "The use of Open Source Software (OSS) can provide advantages in this regard." Wennergren saw it as a problem that outdated conceptions about procurement regulations had hampered DoD in open source adoption. By setting out clear procurement policies clarifying and supporting open source software, the DoD CIO opened the door for innovation. The policy also made the case for open source software's benefits, including substantial cost savings, "continuous and broad peer-review," "unrestricted ability to modify software source code" and a reduction in vendor lock-in.[55]

Case in point: the National Reconnaissance Office (NRO) manages the nation's spy satellites and is a big fan of open source software. NRO launched a top secret cloud to store its reconnaissance data, according to agency CIO Jill Singer. The open source cloud "was set up in 15 months, engulfing a tiny $13 million and requiring just 11 people." The price of the project was so much less than closed-source alternatives that its risk was also dramatically reduced. The approach paid off, and the project was a major success.[56]

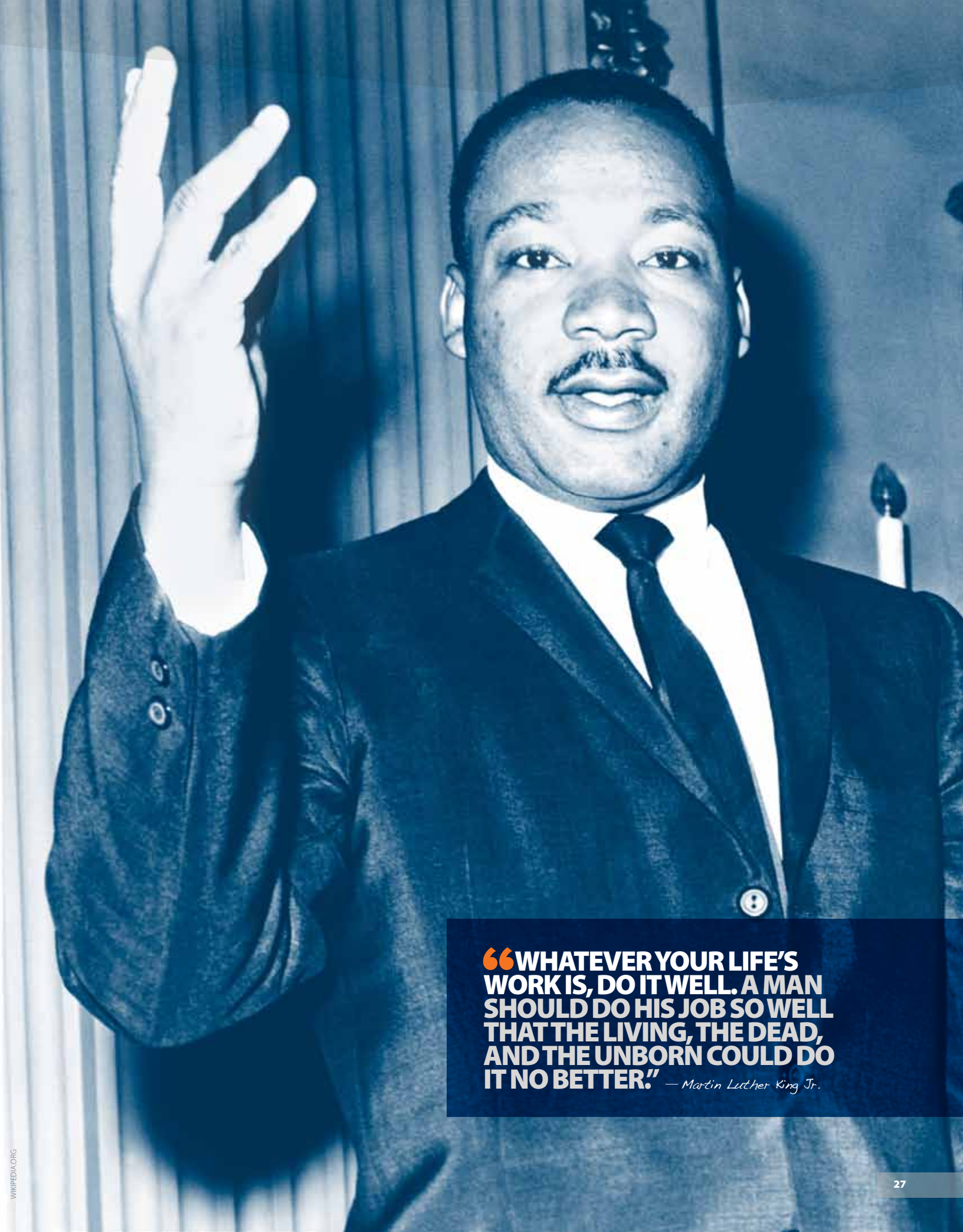
DoD has also taken a lead role in promoting the sharing of software among federal agencies. Much of this is through the federal "Shared First" initiative that provides a forum and incentive for agencies to collaborate. Federal CIO Steve VanRoekel said of the program, "We're looking for opportunities to ... build on existing investments rather than re-inventing the wheel."[57] Open source is so popular in the national security community that several agencies are even working to create their own open source software foundation to spur further innovation.[58]

Another exciting example of procurement reform is in the number of CIOs who are turning to purchasing cooperatives that are run either by other government agencies or by a consortium of government or non-government players. These cooperative purchasing organizations give CIOs powerful tools to obtain the best technology and still meet all of their relevant purchasing rules and regulations. In these arrangements, one organization acts as a buyer on behalf of many others. They run competitive bids, make evaluations and award master contracts. When another government entity wishes to purchase something, it can simply write purchase orders against the already competitively bid master contracts.

U.S. Communities Government Purchasing Alliance is one such program. U.S. Communities was founded by the National Association of Counties (NACO), the National League of Cities (NLC) and a number of other allied organizations. In this model, all contracts are competitively procured by an individual public entity. Certain language is included in contracts to allow other entities to share the contract. U.S. Communities functions as a purchasing co-op, and drives down prices for goods and services. Sometimes governments can even purchase integrated solutions that combine hardware and services into a single, streamlined purchase order.[59]

Texas runs a similar program under the aegis of the state CIO. Texas has become a strong negotiator with vendors, often obtaining significant volume discounts. In the first quarter of this year, more than $415 million of purchases of IT goods and services went through Texas' cooperative contracts, generating an astounding cost avoidance/savings of $66 million. Even though the Texas program is headed by one state agency, the savings are enjoyed by government customers outside of Texas state government, including "school districts, counties, cities, libraries, fire departments" and about 15 other state governments, which together comprise about 75 percent of DIR's customer base. And it's important to note that, for them, doing business with DIR is entirely voluntary. ■

COOPERATIVE PURCHASING ORGANIZATIONS GIVE CIOS POWERFUL TOOLS TO OBTAIN THE BEST TECHNOLOGY AND STILL MEET ALL OF THEIR RELEVANT PURCHASING RULES AND REGULATIONS.



"WHATEVER YOUR LIFE'S WORK IS, DO IT WELL. A MAN SHOULD DO HIS JOB SO WELL THAT THE LIVING, THE DEAD, AND THE UNBORN COULD DO IT NO BETTER." — Martin Luther King Jr.

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Writing Your Legacy, One Page at a Time

We've come to the end of our journey into the legacy of a CIO. In the process, we've taken a three-dimensional look at the concept of legacy — past, present and future. We've learned from the successes — and challenges — of our peers. And we've provided a framework and a set of tools that you can use to craft a great legacy for your organization.

Many of the great works of the past — like the Panama Canal and Transcontinental Railroad — might have seemed like more trouble than they were worth at the time. They required clear vision, steadfast commitment and a never-give-up attitude. But they were finally accomplished, and over time their value has been proven — even far beyond any of their creators' expectations. Sure, we've seen more than our fair share of faddish predictions like flying cars, disposable clothing and the like find their way to the dustbin of history. But this moment in government technology seems more laden with opportunity than with risk. So the question falls to you: What fate will meet the work that you do? What will remain of your efforts after you have moved on? What will be your legacy? ■

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JOHN MIRI is the editor-in-chief for the Center for Digital Government. After a successful career as a private sector software executive, Miri was appointed by the Texas governor to the top regulatory board overseeing statewide electronic government. He went on to lead transformational projects for two successive Texas state chief technology officers and has become an advisor and close confidant to leading state and local government CIOs around the nation. As the former director of E-Government and Web Services for the state of Texas, Miri led the state to breakthrough results of 829 online services, 83 million citizen financial transactions and $5 billion in online revenue. He helped found three Web-based technology companies that leveraged Web 2.0 and cloud computing to achieve dramatic results for clients in the commercial markets. Miri has been a passionate advocate of next-generation Internet technologies for more than a decade and is a nationally recognized speaker and author on government technology.

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