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LOOKING FORWARD
5 Tech Trends Shaping 2021

Executive Summary

In this report, we look at the events of 2020 and think about how they might shape the use of technology in 2021 and beyond. But we do it knowing full well that this year might bring unanticipated or unimaginable challenges that alter the technology landscape (see 2020 for a case in point).

Still, this exercise provides an interesting way to reflect on the state of IT in the public sector. Although the challenges of 2021 might be quite different from those of 2020 (or so we hope), government agencies are likely to benefit from the knowledge they gained in the past year. In this report, we try to distill some of that knowledge.

- **We begin by looking back at 2020** and the major themes that emerged as government agencies dealt with the pandemic and all that came with it.
- **Then we look forward to 2021** by highlighting five technologies that could put agencies on better footing to deal with whatever the future holds. Some of the technologies, such as analytics, will be familiar, while others – zero trust and edge – might be less so.

But we also want to keep it real. So we talked with IT leaders in federal, state and local governments about the challenges they are facing and how they hope technology might help.

The message? Don't get caught up in talk about emerging technology, modernization and innovation. Be pragmatic.

In the words of Duane Schell, Chief Technology Officer (CTO) for North Dakota:

> *"If you're implementing tech for the sake of tech, you're doing it wrong. The question is, does that technology solve a business need? Does that technology help you serve the citizens or your stakeholders in a better way?"*

In that spirit, we close with four key take-aways that distill what we learned in our research and reporting. However our prognostications play out, we hope that this guide provides you with insights and ideas that help you in the year ahead.

John Monroe
Director of Content, GovLoop

Contents

Carahsoft and GovLoop have partnered to provide resources around the latest federal, state and local tech trends. The goal is to better inform government leaders' 2021 planning and enable their modernization initiatives with the latest technology.

2020: The Year of ***Sudden Transformation***

At some point in 2020, the so-called "new normal" stopped feeling new.

Although agencies hope to return to "normal" operations at some point in the future, there's a growing sense that many of the changes the pandemic triggered may endure long after the workforce returns to their offices. In many cases, agencies responded to the crisis by adopting new technologies or creating new work processes that either fixed existing problems or addressed long-term goals.

Here is a look at some of the ways in which the events of 2020 could have a lasting impact on how agencies operate.

Modernization on the Fast Track

In many cases, the abrupt shift to remote work was a stress test for agencies' networks and systems that brought to light limits in bandwidth or performance that were not apparent before.

That was the case at NASA, where network outages early in the pandemic prompted quick changes to the network architecture, said Jeff Seaton, the agency's Acting Chief Information Officer (CIO), in a recent interview.

"I like to say that we experienced three years of transformation in the first three months of the pandemic," Seaton said.

Many agencies also scrambled to make applications and data more readily accessible to employees working from home. The public cloud was often the platform of choice because new solutions could be deployed without having to expand on-premises infrastructure.

For example, Sparks, Nevada, found itself accelerating to the cloud much faster than it had planned before COVID-19. Ty Reid, IT Security Specialist for the city, spoke on this at a GovLoop virtual summit in August 2020.

"If it wasn't for the cloud, this would have been a lot more painful," Reid.

In the case of cloud solutions, some agencies might choose to scale back those offerings once employees return to the office. But other changes are likely to stick.

That is the case at the Federal Deposit Insurance Corporation (FDIC), which realized early in the pandemic that it needed remote and automated tools to minimize the number of employees needed at a bank closing.

"This situation has been almost like a live proof of concept, and in many cases, things have been proven," FDIC CIO Sylvia Burns said in an interview with GovLoop last spring. "I would say that some of my colleagues who lead other mission areas of the FDIC are saying, 'Well, you know what, why would we go back?'"

Take-away: Modernization is a much more compelling mandate when it supports initiatives that touch the lives of constituents.

A Pivot to Digital Services

With government offices closed or operating at reduced capacity during the pandemic, many state and local agencies expanded their use of digital services to provide information and services to the public.

Often, they could leverage existing services. For example, Colorado added COVID-19-related resources to its myColorado mobile app. The app provides information on the pandemic and links for people looking to access food, cash and early childhood assistance benefits.

But the surge in demand for services often taxed the underlying systems, especially at state labor departments as unemployment claims skyrocketed.

Early in the pandemic, Delaware's Department of Technology and Information (DTI) added a monitoring function to the Labor Department's online resources. If the system detected a spike in activity, DTI could add more processing power before performance suffered.

DTI also added automated tracking messaging to unemployment claims so that applicants knew the status of their claims, reducing the burden on the state's call center.

Even once government offices return to full capacity, IT leaders expect to see continued demand for digital services. A 2020 survey by IDC found that 100% of government executives said that digital transformation was a priority, and that 59% said they were facing pressure to execute a digital experience strategy.

The pandemic has only upped the ante.

"I...think that we will see an acceleration of digital government because citizens have now been forced to engage government digitally," said James Collins, then-CIO of Delaware, in an interview with GovLoop. "They're going to get accustomed to getting services from anywhere, at any time, from any device."

Take-away: It's all about the return on investment. Digital services take hold when they provide measurable benefits to agencies and the constituents they serve.

Digging Deep into Data

Data has played a central role in guiding how agencies at all levels respond to the pandemic. We've all learned to read the online dashboards showing the numbers of COVID-19 cases and deaths and the rise and fall in rolling 14-day averages. But those on the frontlines of the response must dig much deeper.

A recurring issue has been tracking the availability of beds in intensive care units and ventilators across a city or state's health system.

In Illinois, three full-time employees used to gather such data manually by logging into different hospital systems and extracting Microsoft Excel files. Tammy Roust, the state's Chief Data Officer (CDO), led an effort to automate that process – from gathering and analyzing the data to visualizing and sharing the results.

Officials have also used data to look at the impact of the pandemic across demographics. For example, a study by the federal Substance Abuse and Mental Health Services Administration found that COVID-19 "has revealed deep-seated inequities in health care for communities of color and amplifies social and economic factors that contribute to poor health outcomes."

In the early days of the pandemic, such inequities were difficult to prove. In April 2020, only 27 states reported COVID-19 cases by race and only 22 reported deaths by race, according to the State Health Access Data Assistance Center, a health policy research organization. Now, all 50 states report such data.

"Collecting disaggregated demographic data on the impact of COVID-19 is one way to advance health equity during response efforts," wrote Emily Zylla, a Senior Research Fellow at the center, and Sydney Bernard, a Research Assistant, in a recent blog post.

In April 2020, the State CDO Network, based at the Beeck Center for Social Impact and Innovation at Georgetown University, published a report highlighting seven ways that CDOs could assist with the response to the pandemic, from coordinating data management and making data discoverable to formatting it to be useful and centralizing data access across agencies.

Take-away: As much as any event in recent memory, the pandemic has proven the value of using data to shape policies and initiatives.

Cybersecurity Looms Large

In December 2020, news broke that Russian hackers had exploited compromised software patches to access a wide range of federal government systems. An alert from the Cybersecurity and Infrastructure Security Agency (CISA) noted that the hackers likely used tactics, techniques and procedures not yet seen before.

But security was a major concern throughout the year, in part because of the pandemic. With many people working from home and using shared home networks, cyber experts worried about agency resources being exposed to unknown vulnerabilities.

Malicious actors also sought ways to use heightened interest in COVID-19-related information to launch phishing attacks. In October 2020 the FBI warned the public about scammers fraudulently soliciting donations for individuals, groups and areas affected by COVID-19 as a way to steal both money and personal information.

At the state and local levels, cybercriminals have used phishing to launch ransomware attacks. No agency is immune from such attacks, but cities and counties are often attacked because they are seen as "soft" targets.

In a 2020 report, the National Association of State CIOs (NASCIO) noted that nearly half of all states do not have a dedicated cyber budget. Of those states that do, most are between zero and 3% of their overall IT budget, compared with an average of more than 10% in the private sector, NASCIO found.

"Many government organizations, particularly at the local level serving smaller portions of the population, are often challenged on how they spend their limited resources," Texas CISO Nancy Rainosek said in an interview. "This limits their ability to keep systems current and have the IT personnel on staff to adequately handle ransomware events."

A growing number of states have developed programs to help state and local agencies with cybersecurity initiatives. For example, in North Carolina, DTI has partnered with the National Guard and the state Emergency Management agency to help local governments, school systems and community colleges remediate and recover from cyberattacks.

Take-away: With ransomware and other threats, the potential cost of not investing in cybersecurity steepens all the time.

New Ways of Thinking

At a higher level, the events of 2020 led many agencies to rethink how work gets done and services are delivered.

Telework is a case in point. Many government leaders who were skeptical about telework have seen that it is both doable and beneficial. For example, an Air Force official said in September 2020 that as many as one-third of its remote workers could continue teleworking after the pandemic.

The Small Business Administration sees an opportunity to use remote work to attract new talent, said then-Deputy CIO Guy Cavallo, in an interview with GovLoop in August 2020.

Continuity of Operations Planning (COOP) also is getting a new look in many agencies. Such plans typically are written with short-term, local events in mind, not something like 2020's extended crises.

Government agencies need to stop thinking of COOP as a checklist of tasks, said Lou Reinbold, Human Resources Manager of the Las Vegas Water Valley District, Southern Nevada Water Authority and Springs Preserve, speaking during a GovLoop webinar in July 2020.

Instead, COOP should be approached as a process or activity, Reinbold said. So, rather than focusing strictly on tasks, the plan should outline a clear chain of command that identifies the people who will guide response efforts and make decisions in real time, he said.

In many areas, however, new ways of thinking will require policy changes. With that in mind, the Air Force has undertaken an initiative called Operation Flamethrower that aims to identify policies and guidance that make it difficult for the service to work in new ways.

"There are a lot of policies that, when they were written, made a lot of sense. But they're 10, 15, 20 years old, and things change quickly, especially in this day and age in IT and cyber," said Rob Beutel, the Air Force's Deputy CTO, speaking during a GovLoop webinar in November 2020.

Take-away: Remote work and other challenges did not create new problems for agencies; they simply highlighted problems that already needed to be addressed.

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Redrawing the IT Roadmap for 2021

An interview with Brandon Shopp, Vice President of Products, SolarWinds

The large-scale shift to remote work in March 2020 raised numerous questions for agencies about their network infrastructure: Would employees still be able to access the resources they needed to do their jobs? Would bottlenecks diminish their productivity? What was the most effective way to secure this distributed environment?

But even before the pandemic, many agencies were already dealing with an increasingly complex network architecture, and this trend is certain to continue. So how can they manage this environment more effectively?

GovLoop put this question to Brandon Shopp, Vice President of Products at SolarWinds, which provides IT infrastructure management software. He recommended three best practices.

Use Metrics to Get Visibility Into Real-Time Operations

At the beginning of the pandemic, many agency leaders were concerned the remote work environment would make it difficult for their employees to stay productive. In fact, the surge in virtual private network (VPN) connections and in the use of video conferencing and other collaboration tools often led to network bottlenecks that disrupted daily work routines. This is why metrics are so important.

In one case, SolarWinds worked with an agency to leverage performance metrics to get visibility into their networks and identify emerging problems in real time. These metrics fed what the agency called COVID dashboards, which proved to be a boon to its network operations centers, Shopp said.

Use Historical Data to Drive Infrastructure Planning

To develop a realistic infrastructure strategy, you need to understand the demands being put on your infrastructure over time. For example, if a given application consistently eats up the available compute capacity, you can justify beefing up your on-premises infrastructure.

If, on the other hand, you see only occasional or periodic spikes, you might look at migrating the application so you can pay for increased capacity on an as-needed basis.

In the long run, a data-driven strategy will help agencies develop budgets and modernization strategies better reflecting their IT requirements.

"Having performance data allows you to make more informed decisions about your priorities based on data rather than on a hypothesis or belief," Shopp said.

Treat Remote Users, Offices as Part of the Norm

Before the pandemic, most organizations tended to treat remote users, and even remote offices, as exceptions to the norm. The most common solution? Link them back to the data center via VPNs.

But the pandemic showed VPNs, while useful, don't work well at scale. A better approach, Shopp said, is to push the infrastructure to the edge—that is, push it closer to those remote users and offices rather than forcing them to rely on IT services back at the data center.

Agencies should also look to develop standardized configurations for their extended infrastructure. This consistency will make it easier to set up, maintain and troubleshoot the infrastructure, he said.

Taken all together, it comes back to "looking at your IT road map and making sure the organization understands how their focus might have to pivot given the challenges that arose in 2020," Shopp said.

2020: A Year of *Validation* for North Dakota's IT Strategy

An interview with Duane Schell, CTO, North Dakota

You might think that the events of 2020 would have left a state IT department in disarray. But while the pandemic disrupted IT operations and services in ways that were previously unimaginable, Schell said the experience also demonstrated the value of the state's IT strategy.

IT proved crucial in enabling the state to respond to the crisis, both in helping the workforce shift to a remote work environment and in ensuring the continued delivery of services to the public.

Late last year, Schell spoke with GovLoop about how he sees the experiences of 2020 shaping his state's IT strategy for years to come.

Eye on Emerging Tech

As CTO, Schell manages a large IT portfolio that includes data centers, networks, cloud operations and an extensive array of business applications. In addition to supporting state agencies, his team also provides services to local government, K-12 education and higher education.

This large stakeholder base defines how Schell and his team evaluate the potential role of emerging technology in the state's IT operations. Their approach always must be pragmatic.

> "We've got our research teams and our architecture teams that are constantly evaluating the marketplace and what's coming and what it might do for us. But it almost always comes down to what is the problem you're trying to solve. If you're implementing tech for the sake of tech, you're doing it wrong. The question is, does that technology solve a business need? Does that technology help you serve the citizens or your stakeholders in a better way? And if it does, how might you incorporate it into your portfolio of tools? We don't chase every new shiny object, but we are aggressive when we see things that are going to make a positive impact."

One area of growing interest is drone technology, as the state looks to support the safe use of unmanned aerial vehicles (UAV) and unmanned aircraft systems (UAS).

> "In North Dakota, we've got the Northern Plains UAS Test Site, which is one of the leading UAS/UAV test sites in the country. During the last legislative assembly, there were some dollars put aside to build out a statewide beyond-visual-line-of-site network. It's a public/private partnership that's trying to drive toward a future where you've got drone technology that can be leveraged safely in airspace. Being a part of those conversations, being a part of helping to solve those challenges is really exciting and a lot a fun."

But Schell also recognizes that those stakeholders vary widely in the maturity of their IT operations.

> "There are some organizations where getting paper processes online feels like emerging tech to them, whereas some of our more mature organizations are looking to take it to the next level, incorporating more intelligent capabilities with analytics and robotic process automation. They're really trying to speed the delivery of services and drive efficiencies – and to repurpose those cycles into other value-added services to the stakeholders or possibly even drive down the cost of government."

IT Gets a Fresh Look

But going forward, Schell expects to see more interest in emerging technologies such as automation – in large part because the pandemic has provided countless use cases for adopting new capabilities.

> "The whole pandemic absolutely has had [an] impact on IT. You know, pre-COVID, government never would have imagined the amount of telework that we're doing today and the speed with which we're introducing technology. But as we look at the demand that's been placed on government because of the pandemic in any number of areas, people are exceedingly open-minded to things. Organizations that didn't fully appreciate the value of automation and bots are now openly embracing it."

Likewise, agencies have seen how digital services have given them more flexibility in how they provide services to the public.

> "Pre-COVID, we had conversations around a vision of government where no citizen would ever have to go to a physical location to acquire services from government. At the time, people thought we were a little over the top, and now, in the world of social distancing, that's exactly what you want to do: You want to make sure everything's online and that you don't have people standing in lines where they put themselves at risk. And if they can acquire the service from the comfort of their home, where they're safe, and if they can do it on whatever device they happen to have, that's where we want them to be."

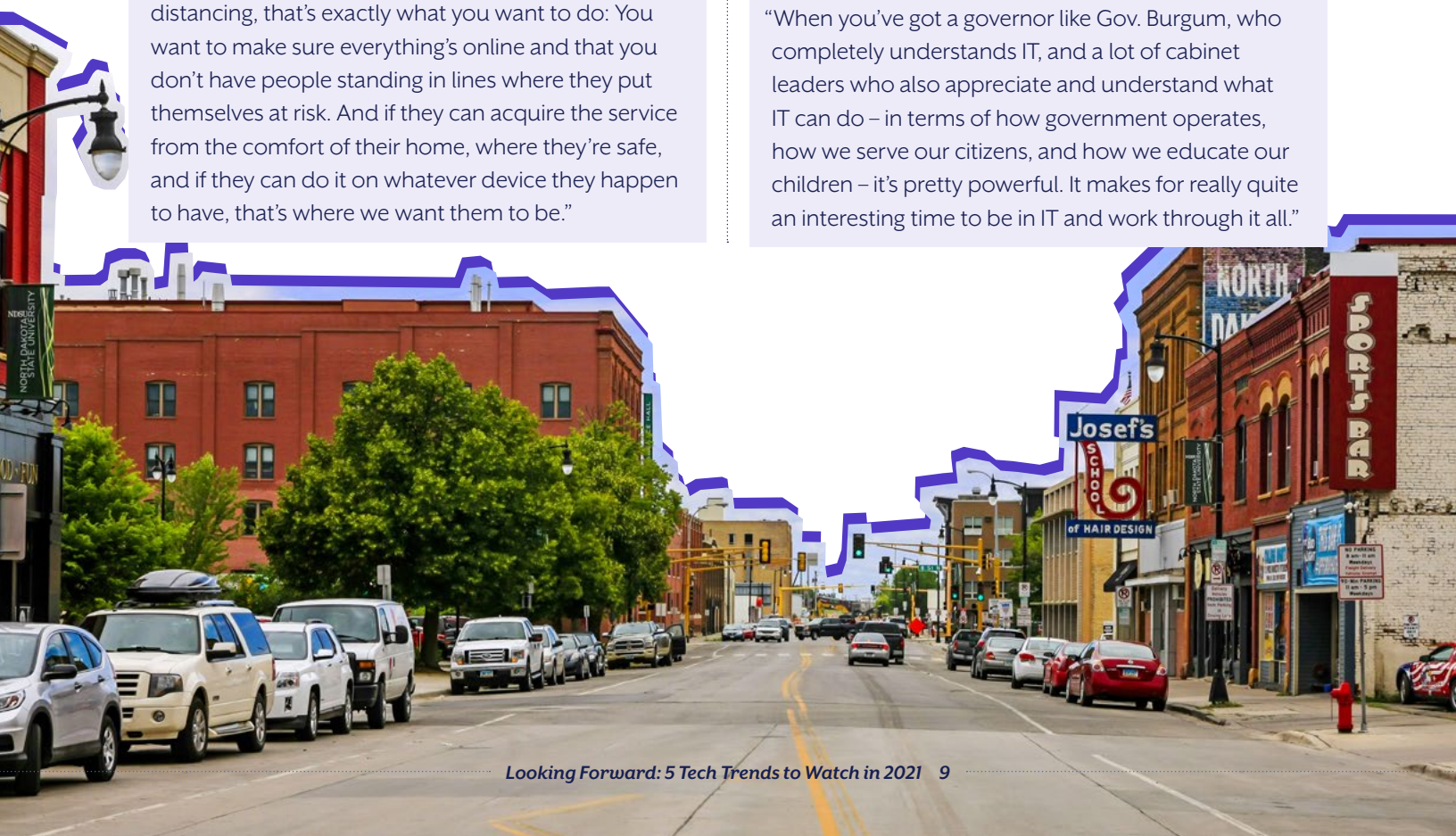
The Pandemic and Beyond

In the long run, the pandemic has given more weight to the state's IT strategy, Schell said, although the pandemic will continue to shape its strategy in the short term.

> "In so many ways it really has not changed our strategy. In fact, it has confirmed our strategies. What we did in 2020 and what we're probably going to be doing in 2021 might look a little different, just because of the demands of the pandemic and all of the secondary and tertiary things associated with it. But the strategies, I think, are still very much intact. We're still looking for a government presence that is highly digital, that's highly efficient, that serves the citizens when and how they want to be served. Those strategies remain.
>
> "But, as you know, the pandemic has had significant economic impacts across the country. As we step into 2021, I fully expect a huge focus will be on how we can drive down the cost of government, and how technology can help do that."

Schell's optimism about the future reflects the support that he receives from Gov. Doug Burgum.

> "When you've got a governor like Gov. Burgum, who completely understands IT, and a lot of cabinet leaders who also appreciate and understand what IT can do – in terms of how government operates, how we serve our citizens, and how we educate our children – it's pretty powerful. It makes for really quite an interesting time to be in IT and work through it all."



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*Accenture Legacy or Legend Report, 2020

It's Time to Think About Mainframes in New Ways

An interview with Sujay Solomon, Manager, Product Management, Broadcom

The mainframe has a well-deserved reputation as the workhorse of IT operations. But it also has a growing edge as a platform for enterprise innovation.

The idea is to let the mainframe do what it does well — managing enterprise-class applications and data — while also integrating it more fully with the modern IT environment through the cloud, open source software, application program interfaces and modern methodologies such as DevOps.

"You can integrate all of that together and find the sweet spot where you're getting the most value out of the platforms you're leveraging," said Sujay Solomon, Manager, Product Management for Broadcom, which provides semiconductor and infrastructure software solutions.

Solomon highlighted three advantages of bringing open, cross-platform enterprise innovation to the mainframe.

The ability to leverage all the benefits of open source tools/ frameworks

Traditionally, mainframe developers have worked in a silo, using their own tools and processes. In part, that's because mainframe-based applications and data often require high levels of security and privacy.

However, such concerns do not mean that mainframe developers can't leverage open source tools and take advantage of all the innovations they make possible, said Solomon. "It's just done in a very structured, formalized fashion, where there's approvals needed before you can use that software," he said.

One option is to work with open source organizations, such as the Linux Foundation or the Eclipse Foundation, that have a history of providing secure, enterprise-grade software, he added.

The ability to minimize disruption by modernizing-in-place

When it comes to the mainframe, agencies tend to be wary of any changes that might disrupt operations. For example, while they might want to shift to DevOps, they can't afford for their mainframe staff to take a lot of time away from work to learn new tools and methodologies.

The solution, said Solomon, is to allow existing staff to continue working with legacy tools while providing new staff with modern tools. "The beauty of this approach is that it's not one or the other," he said. "People on the same team could be working on the same pieces of code and managing the same deployment, but each using the interface they prefer."

The ability to attract new talent and expand the existing skills base

As long as mainframe operations stick to legacy tools and processes, they will struggle to hire new workers. In part, that's because the latest generation of IT talent is being trained in open source and DevOps, not in mainframes.

But it's more than that. Modern development tools and methodologies also cultivate a more collaborative development process, Solomon said, "which ultimately makes the product better and the team better as a whole."

Broadcom knows it's not easy to get started with bringing open source and DevOps to the mainframe, but they also know it's important. With that in mind, Broadcom works closely with customers to develop a roadmap for moving the mainframe into the open world, Solomon said.

2021: The Year of...

...Analytics

...Artificial Intelligence

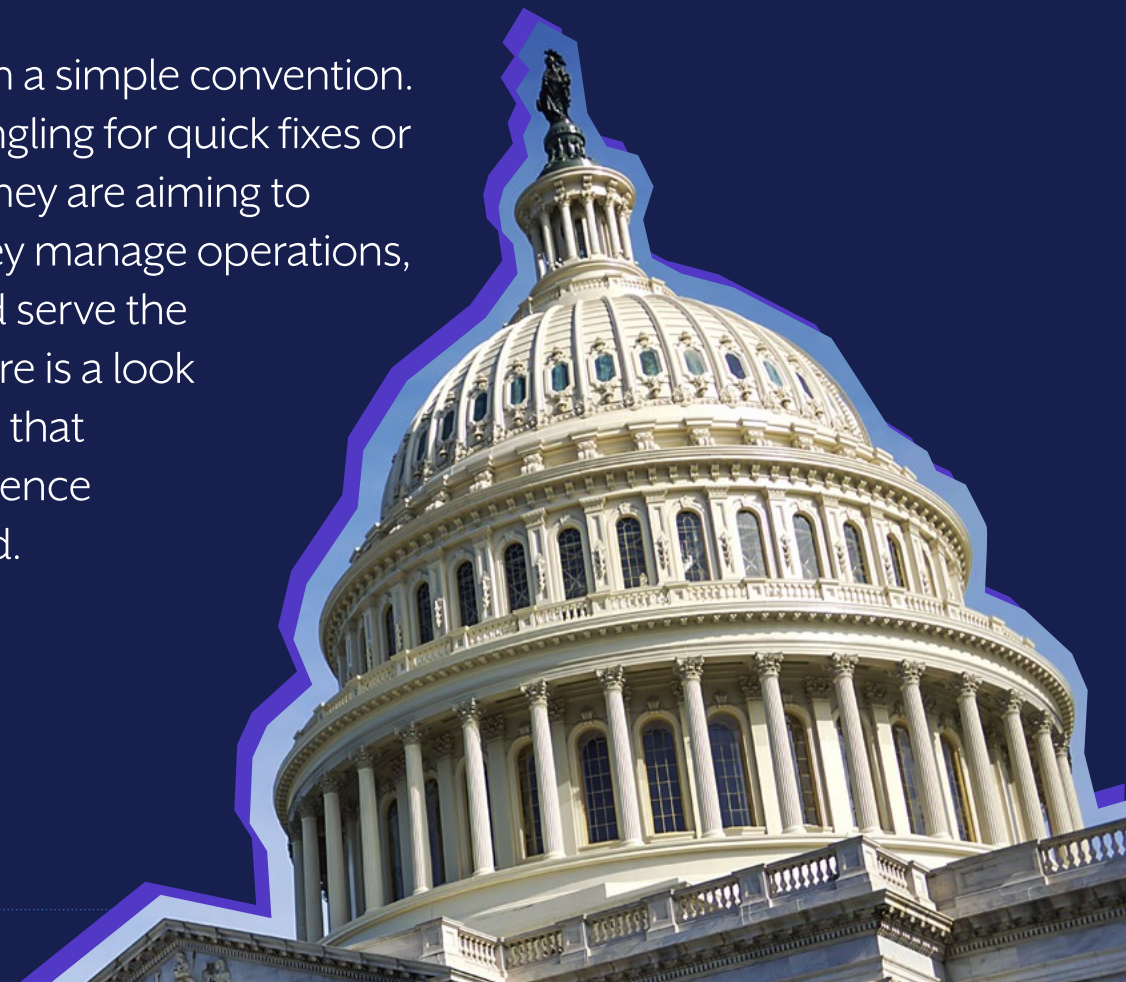
...Cloud-Native

...Zero Trust

...Edge Computing

Many years see the emergence of one particular technology that seems to dominate the discussion. It's not necessarily a new technology, but one that speaks to the needs of the moment. Technology journalists often christen a given year "The Year of ***X***."

But 2021 defies such a simple convention. Agencies are not angling for quick fixes or simple solutions. They are aiming to reengineer how they manage operations, deliver services and serve the common good. Here is a look at five technologies that might make a difference in 2021 and beyond.



2021: The Year of *Analytics*

Why It Matters

When government agencies talk about big data, they talk about analytics. Analytic tools are the IT equivalent of mining equipment used to collect and refine raw ore. With the right tools, agencies can drill deep into large datasets and bring to the surface insights that inform policy, mission, governance and customer experience. Absent analytics, data is impenetrable.

A Harvard Kennedy School study estimates that governments' use of analytics could generate a total global benefit of $1 trillion. The value accrues to three main areas: financial return attributable to analytics efforts, operational process improvements and transparency that increases public confidence in government.

Laying the Groundwork

Agencies' Benchmarks

Asked how advanced analytics benefit agencies, government employees say good data makes for good government. Among those employees taking a GovLoop survey in 2020, 67% said supporting collaborative decision-making was the top benefit of analytics. Close behind were gaining deeper insights into the performance of agency operations (66%) and gaining deeper insights into customer services (64%).

Chief Data Officers

Federal CDOs convened in January 2020 for the inaugural meeting of the Chief Data Officers Council. The group will focus on "capturing high-value shared opportunities and best practices while recognizing organizational differences and challenges," said Ted Kaouk, the Agriculture Department's CDO and the council's first Chairman.

In the same vein, the Beeck Center's State CDO Network has the goal of "connecting data leaders across states to improve policy and service delivery."

Data Literacy

CDOs are only one piece of the puzzle. The next step is to promote data literacy throughout an agency's workforce. With that in mind, the General Services Administration (GSA) recently published a "Data Skills Catalog" that can help agencies develop competencies for managing data as a strategic asset and making data-driven decisions.

What's on the Horizon

Agencies that have laid the groundwork for implementing data analytics strategies – better data management, acquisition of analytics tools, staff training and incorporation of analytics into workflows – are poised to extract value hidden in data and use it to improve operations and bolster attainment of mission goals. A primary objective will be to advance the practice of evidence-based decision-making at government agencies.

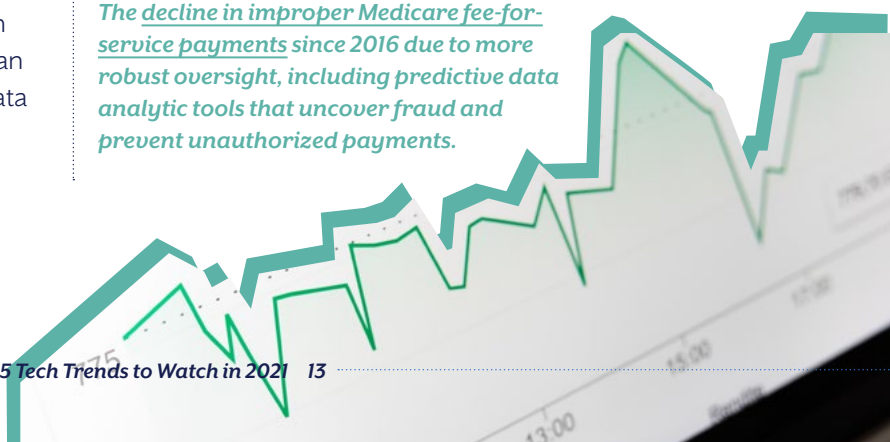
Integrating the component functions of a productive analytics pipeline will be an ongoing process. The path ahead must accommodate disparate data streams, evolving IT capabilities and the shifting requirements of agencies' end users, an effort that will continue long after the current health crisis has abated.

"There's going to be a lot of policy questions that need some good data analysis and research even after we're through with this pandemic," said John Correllus, CDO for North Carolina.

A strong framework will connect multiple datasets and execute robust analysis, quickly and clearly.

$15 billion

The decline in improper Medicare fee-for-service payments since 2016 due to more robust oversight, including predictive data analytic tools that uncover fraud and prevent unauthorized payments.



2021: The Year of *Artificial Intelligence*

Why It Matters

Just as the steam engine powered advancements during the Industrial Revolution, AI will power the next phase of modernized digital government. In the 19th century, steam transformed transportation, manufacturing and mining. Today, AI is unlocking the value of data, improving decision-making, liberating workers from mundane tasks and improving public interactions with government.

AI-enabled machines' ability to perform tasks requiring skills that in the past had been the exclusive province of humans – communication, language, learning and strategy – will drive efficiency and allow human workers to focus on higher-value tasks. In the digital world of knowledge workers, streaming data, information economies and cyberwarfare, AI will matter more than ever.

Laying the Groundwork

AI Is Here to Help

One growing application of AI is in government contact centers. For example, the Illinois Department of Employment Security is using Google's Contact Center AI to rapidly deploy virtual agents to help more than 1 million residents who lost their jobs to file unemployment claims. Several states, including Mississippi, have even been using Amazon Echo's "Alexa" to help answer people's questions.

OMB Issues Guidelines on AI and Ethics

The Office of Management and Budget issued guidance in 2020 for regulating IT applications built on AI technology. The guidelines seek to regulate AI apps in a way that won't "needlessly hamper AI innovation and growth," according to the memo, citing Executive Order 13859, "Maintaining American Leadership in Artificial Intelligence."

DoD Develops AI Education Strategy

The Defense Department, which unveiled an AI strategy in February 2019, released in 2020 a companion document: its plan for making its workforce AI-ready. "AI is a human-centric endeavor – developed by people, for people – and because humans will ultimately make the decisions that are informed by AI capabilities, an AI ready force is essential to delivering AI at scale," the strategy states.

What's on the Horizon

Using AI to advance government operations is on its way to becoming routine. Until recently, AI was a futuristic technology – poorly understood and often out of reach. AI's imminent liftoff after years on the periphery of possibility is akin to millions of sci-fi fans discovering that they're on the verge of getting their own jetpacks.

In 2021, look for agencies to speed the adoption of AI-enabled applications, vastly improving existing operations and blazing new paths for accomplishing missions. AI will continue to improve public health and safety by making it easier to monitor risks and enforce environmental protection laws. Agencies will use AI to uncover waste, fraud and abuse.

The Securities and Exchange Commission already relies on AI tools to uncover violations of securities laws, practices that provide "a glimpse of a potential revolution in regulatory enforcement," according to a report, "Government by Algorithm: Artificial Intelligence in Federal Administrative Agencies," commissioned by the Administrative Conference of the United States.

OMB reported in October 2020 that AI applications could cull outdated requirements from government regulations. And AI will streamline procurements, evaluate the performance of contractors and predict when government hardware will need maintenance.

45% *of federal agencies have experimented with AI and related machine learning.*

2021: The Year of *Cloud-Native*

Why It Matters

Cloud-native application development is on track to becoming a standard IT practice in government. Cloud-native apps shorten development cycles, speed innovation, deliver higher-quality products, smooth deployments and lower development costs. Traditional development methods are relatively clunky, while "lifting and shifting" non-native apps to the cloud can cause problems such as latency and compromised performance.

Cloud-native computing develops, deploys and runs applications exclusively in the cloud. It typically entails the use of containers and microservices, which build applications or services out of small bundles of code that can be easily deployed to different platforms. It's also often part of a shift to a DevOps methodology, in which development teams work closely with the operations team throughout the development process.

Cloud-native development works well when building highly scalable, complex applications and large apps on tight deadlines.

Laying the Groundwork

In Defense of Cloud-Native

Software applications are central to DoD's continuing operations, from weapons systems and communications channels to billion-dollar procurements and personnel management. That's why DoD continued shifting away from traditional application development methods in 2020. Leveraging DevSecOps and cloud-native approaches makes it possible to securely accelerate cloud-native software development and speed delivery of new weapons to warfighters.

Kessel Run

The Air Force's lauded software factory, Kessel Run, continues to deliver cloud-native software solutions marked by efficiency, flexibility and fast turnarounds. Having proven itself in 2020, Kessel Run will use its development capabilities to effect change at the enterprise level, predicted Lauren Knausenberger, the Air Force's Deputy CIO, in September 2020.

NIST Guidance

The National Institute of Standards and Technology recently announced plans to create a new Special Publication (SP) on DevSecOps practices that brings together and normalizes content from existing guidance and practices publications. It also will update selected NIST publications most closely related to DevSecOps.

What's on the Horizon

Until recently, cloud-native application development in government has largely been the purview of defense and intelligence agencies. The security requirements and high-stakes missions of organizations in those sectors align with and benefit from the characteristics of cloud-native development. Now, organizations governmentwide recognize that the benefits of cloud-native development – faster delivery, enhanced security, stakeholder engagement and a more flexible development process – will serve their missions, too.

The government's traditional approach to software "really isn't agile in meeting customer demands," said Chezian Sivagnanam, Chief Enterprise Architect at the National Science Foundation (NSF), speaking during a GovLoop webinar in February 2020.

Yet cloud-native's reputation as an arcane and esoteric technology won't disappear overnight. For example, it's been only half a dozen years since NSF began its shift to cloud-native Agile development, propelled by stakeholders who were no longer willing to abide customary timelines for the development and delivery of application software.

50%

of new software is being developed exclusively in the cloud. Facilitating connections between technology developers and users promotes development of innovative applications.

2021: The Year of *Zero Trust*

Why It Matters

A decade ago, one of the world's largest cloud providers deployed one of the first enterprisewide zero-trust security architectures. Moved to action by an advanced persistent threat attack, Google began what has become a stampede away from an overreliance on perimeter security and toward zero trust, a security model that shifts the focus of security to networks' most vulnerable threat vector: users. As of 2020, most leading IT platform vendors and cybersecurity providers offer some sort of zero-trust architecture or solution.

Google was ahead of the pack because it knew what other IT enterprises have come to understand: The proliferation of data and IT infrastructure moving to the cloud erodes the efficacy of traditional perimeter security. For government, that means adopting zero trust to offset the risk of conducting operations farther afield, whether running applications in the cloud or computing at the edge.

Laying the Groundwork

Shifting Defense

Sharp expansion of government's remote workforces this year, including at DoD, catalyzed public-sector organizations to prioritize adoption of zero-trust security. In July 2020, the Defense Information Systems Agency announced its intention to release a zero-trust framework by the end of the year.

TIC 3.0

That same month, CISA released a program guidebook for complying with Trusted Internet Connections (TIC) 3.0, a compendium of strategic standards designed to protect agencies' IT vulnerabilities, including mobile and cloud connections, from an evolving threat landscape. A TIC 3.0 "Remote User Use Case" released in December 2020 notes that compatibility between TIC 3.0 and zero trust will require additional controls and measures.

Shipshape Security

For a decade, the Navy has studied the cost-benefit implications of zero-trust cybersecurity architecture. Spurred to action by the pandemic, the service announced in October 2020 that it would move toward adopting zero trust. During the transition, the Navy will continue to support defense in depth perimeter security.

$1 trillion

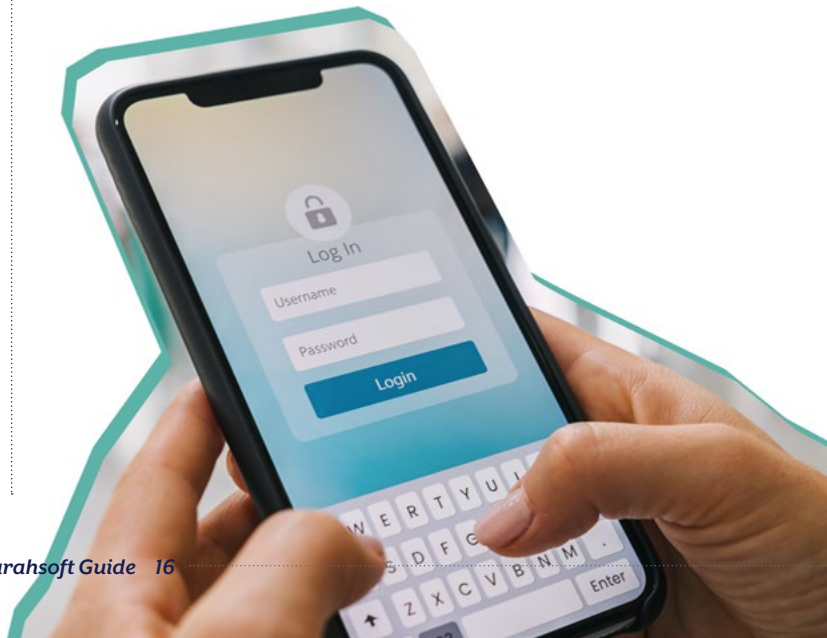
projected total global spending on cybersecurity during the five-year period ending in 2021.

What's on the Horizon

In 2021, more agencies are likely to move toward adopting zero-trust architecture – prompted in part by their experience with remote work, in which unprecedented numbers of users, endpoints and assets were outside the network perimeter. That shift exposed the shortcomings of perimeter security and catalyzed agencies to consider security upgrades that are probably overdue.

Traditional approaches to security had begun to feel dated even before the pandemic, but change won't happen overnight.

Implementing a zero-trust architecture "is a journey rather than a wholesale replacement of infrastructure," advises NIST. "An organization should seek to incrementally implement zero trust principles, process changes, and technology solutions that protect its highest value data assets."



2021: The Year of *Edge Computing*

Why It Matters

A fundamental transformation in network infrastructure is opening the door for edge computing, which Gartner defines as a solution that facilitates data processing at or near the source of data generation.

For years, the DNA of IT enterprises determined that complex systems would have a hub-and-spoke pattern. Computing power, data and hardware resided in the hub. Communications channels (spokes) distributed assets (data and compute resources) to users.

A series of IT developments have uncoupled and decentralized hubs and spokes, rearranging them into patterns that more resemble latticework. Factors driving disruption include the emergence of cloud technology, the proliferation of mobile capabilities and changes in user behavior. In government, that includes 2020's mass migration of government workers to home offices.

The shift toward decentralization and dispersal of assets have made the concept of computing at the source of network activity, a.k.a. the edge, much more appealing.

Laying the Groundwork

It's a Bird...It's a Plane...It's Edge Computing?

Deployed military aircraft and sea vessels continued collecting and analyzing massive amounts of data in 2020, so much so that Chris Cleary, Chief Information Security Officer (CISO) at the Department of the Navy, mused about the proper designation of the F-35 Joint Strike Fighter: Is it an airplane carrying a computer or a computer wrapped in an airplane? Whatever you call it, edge computing lets decision-makers make smart choices.

Surge at the Edge

In October 2019, the Pentagon's Defense Innovation Unit announced a program to that would use a vehicle-mountable device to collect data from battlefields and process it for Army commanders. The move to edge computing recognizes that the volume of defense data pouring in from around the world is growing faster than the military's capacity to analyze it.

Procurement's Edge

GSA recently previewed its next-generation small-business governmentwide contracting vehicle, Polaris. GSA said the vehicle will be a source for agencies to acquire edge computing technologies in addition to AI, machine learning, as-a-service offerings, cloud and cybersecurity technology. The new vehicle will replace the Alliant 2 Small Business contract.

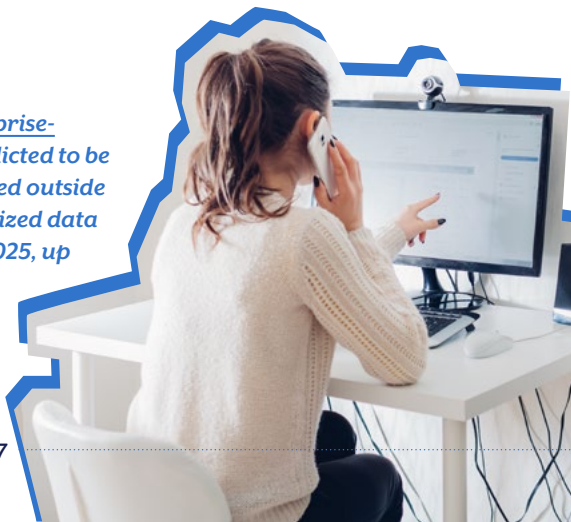
What's on the Horizon

In 2021 and beyond, edge computing will create more opportunities for government agencies seeking access to the cloud, including at the network's edge, that have been inaccessible until now. Government organizations will analyze data in new and more expedient ways, without having to route data streams back to centralized data centers. Edge computing efficiencies will make it possible to glean insights that in the past were difficult to discern or altogether invisible.

Growth of edge computing capabilities will enable agencies governmentwide to process and extract value from data generated by millions of sensors already in service. Those devices are a subset of the Internet of Things, the billions of devices connected to the internet. "Edge computing serves as the decentralized extension of the campus networks, cellular networks, data center networks or the cloud," according to a Gartner report.

75%

the amount of enterprise-generated data predicted to be created and processed outside a traditional centralized data center or cloud by 2025, up from 10% in 2018

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Agencies Find New Ways to Put RPA to Work

An interview with Chris Townsend, Vice President, Federal Sales, UiPath

For government workers, robotic process automation (RPA) will change the productivity equation.

In recent years, the productivity of government staff has been constrained by the math, with the number of employees staying steady or shrinking while the number of constituents and programs continues to rise. For agencies, RPA serves as a force multiplier, offloading the repetitive, process-driven tasks from employees and freeing them to focus on higher value work.

But that's just the beginning, said Chris Townsend, Vice President of Federal Sales at UiPath, which provides RPA solutions. "What's most exciting to me is the ability of RPA to make a mission impact — to really start to solve some big mission problems in government," he said.

To realize that full potential, however, agencies need to think about RPA in new ways. Townsend highlighted three key points

1. RPA goes beyond the back office

Agencies often bring in RPA to help with back-office functions, such as human resources or finance, where repetitive, process-driven work abounds. But process-driven work also is found in many mission areas, said Townsend.

For example, RPA has helped the Veterans Administration handle a surge of paperwork that came with the VA Mission Act of 2018, which permits veterans to file claims for care received outside VA medical centers in certain conditions.

When the program began, it would take 10 VA workers (who had to be reassigned from other jobs) to process 450 claims in a day. As part of pilot projects with several medical centers, 2 bots were able to process over 11,000 records improving throughput by up to 90%.

2. RPA goes beyond mundane tasks

In the early days of RPA, bots were limited to mundane tasks that involved no human reasoning. But artificial intelligence is rewriting those rules, said Townsend.

"With the injection of AI, we can do some basic cognitive tasks, and really improve the capability of the automation platform, while providing a path for agencies to leverage AI in a practical way," he said.

For example, UiPath has been working with the U.S. Patent and Trademark Office to see how RPA can automate the processing of patent applications, getting them to the adjudication phase more quickly. UiPath AI Center provides a framework that agencies can adopt quickly.

3. RPA plays by security rules

RPA might be a new twist on automation, but the same security rules apply. Agencies using RPA must implement the controls they enable for any other software and continue to enforce roles-based access to robots, said Townsend.

Additionally, UiPath provides an Automation Operation Model, "which is a very robust operating and governance model for how to manage your enterprise bot infrastructure," he said.

UiPath believes that RPA will change how agencies think about automation, elevating it to a concern not just of the IT staff but of the larger organization.

"From the top down, UiPath is really focused on helping our customers use the technology to benefit their entire organization," Townsend said.

Shreveport Brings *DIY Mindset* to Innovation

An interview with Keith Hanson, CTO, Shreveport, Louisiana

Shreveport CTO Keith Hanson describes himself as a chief innovation officer and IT director smashed into one. As the unofficial chief innovation officer, he sees his role as pushing his team and city stakeholders to think in new ways about how to use technology to serve the public. As IT director, he must work within the constraints of the city's budget, policies and processes to get that done.

The task does not daunt Hanson, who joined Shreveport as CTO in late 2019. Formerly the head of a software development organization, Hanson brings a do-it-yourself (DIY) mentality to the job – and so far, he has made it work.

Late last year, he talked with GovLoop about what his team accomplished in 2020 and his vision for the year ahead.

A Different Mindset

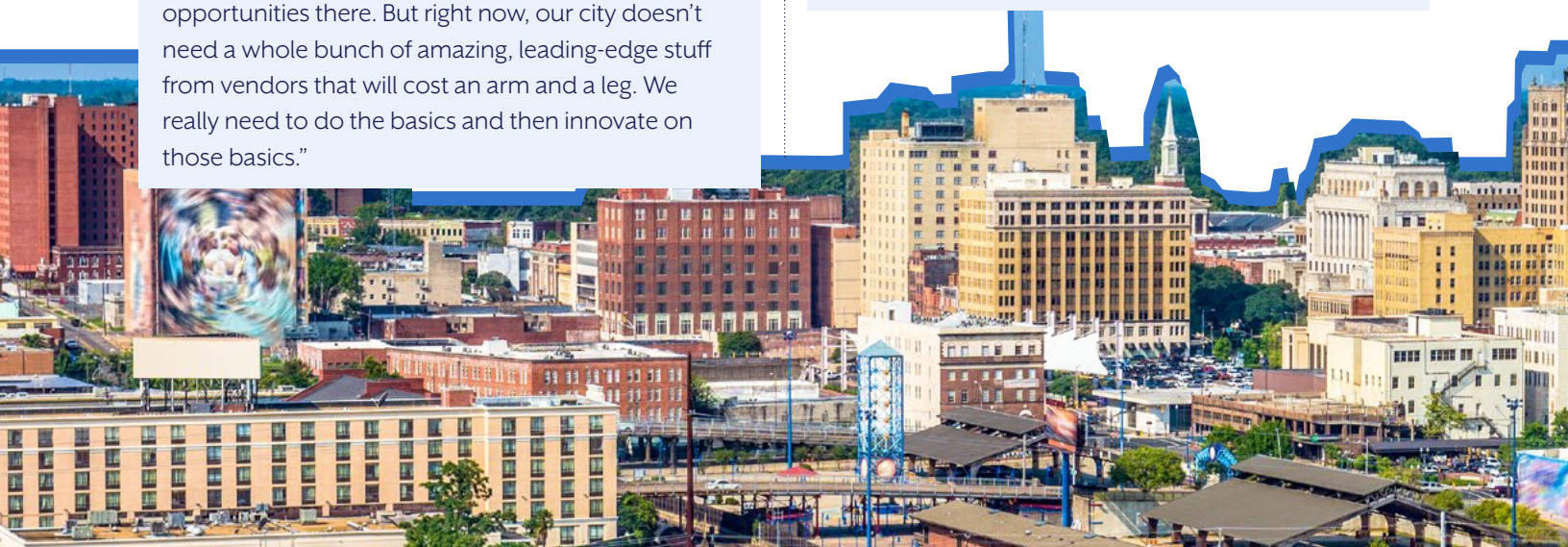
Because of his time in the private sector, Hanson is familiar with cutting-edge strategies for building and deploying IT services. But he also knows that such strategies are not necessarily a natural fit for city government. That doesn't mean innovation isn't possible. It just takes a different mindset.

A good example is his approach to creating a 311 service – a system through which people can find information, request services or report problems, such as potholes. Even a simple 311 service can be a platform for innovation, Hanson said.

> "A lot of times, I'm looking for things that are easy to understand for citizens and actually do something for us right now. 311 is an example. That doesn't have to be whiz-bang. I don't need AI across that, although we could apply it, you know – there are a lot of opportunities there. But right now, our city doesn't need a whole bunch of amazing, leading-edge stuff from vendors that will cost an arm and a leg. We really need to do the basics and then innovate on those basics."

Case in point: How might the city use its fleet of garbage trucks to identify and address problems of blight before residents report them? Hanson and his team realized that they could put cameras on garbage trucks to detect piles of dumped tires, for example, and automatically file reports through the 311 system. The result? Citywide intelligence every week.

> "To me, that's how we can apply a lot of really fancy stuff for the basics of how a city should be run. You know, blight kills people's morale about their city. As a government official, I know that when you think about the percentage of square footage that is covered in blight, it's small. But the problem is that the citizens see it every single day – every single time they go to work, every single time they come home. If we can detect that stuff before the citizen does, or if we can corroborate a citizen's report with a video feed that came in, that's the kind of stuff I want to see."



DIY Smart City

That project is just one element in a broader smart city initiative that reflects Hanson's DIY approach.

Typically, a smart city uses an expansive array of sensors to monitor and analyze operations and services. But Hanson realized the city could take a more modest, iterative approach to building up its capabilities.

> "No, we don't have fiber under every light pole, and there's not a camera on every light pole, and I don't have 200 temperature sensors across the city communicating over [low-range local-area networks] or other really cool smart city stuff like that yet. But what we are doing is taking advantage of our mobile fleet and turning that stuff into smart sensors that crawl through our city. For example, while our police department doesn't touch every street, the patrol cars touch a lot of streets, so there's a lot of interesting data that we can get as they roll around."

Hanson is also using this sensors-on-wheels approach to support the city's Universal Broadband program, which eventually will provide the backbone for its smart city initiative. That initiative took on new urgency with the pandemic, because so many families needed connectivity to work or attend school from home.

> "When COVID hit, we started seeing so many people need some kind of internet connection. It got me thinking: Where is all our wireless? Isn't wireless something that you can detect outside of the door with your phone? Because if they've got Wi-Fi, then they've probably got internet. At first I thought, Do you get the water meter readers to do this? They do certainly hit every house every month. But then I thought about the garbage trucks again and how they go down every single street every single week. How can I expose all of that information to the city without burdening the staff that are driving the truck?"

Now, each truck is equipped with an LTE sensor for detecting network connections, a GPS sensor for capturing location data and a low-cost, credit card-size computer known as Raspberry Pi for processing the data. As the trucks traverse the city, they provide a detailed picture of network connectivity that can be used to develop a broadband strategy.

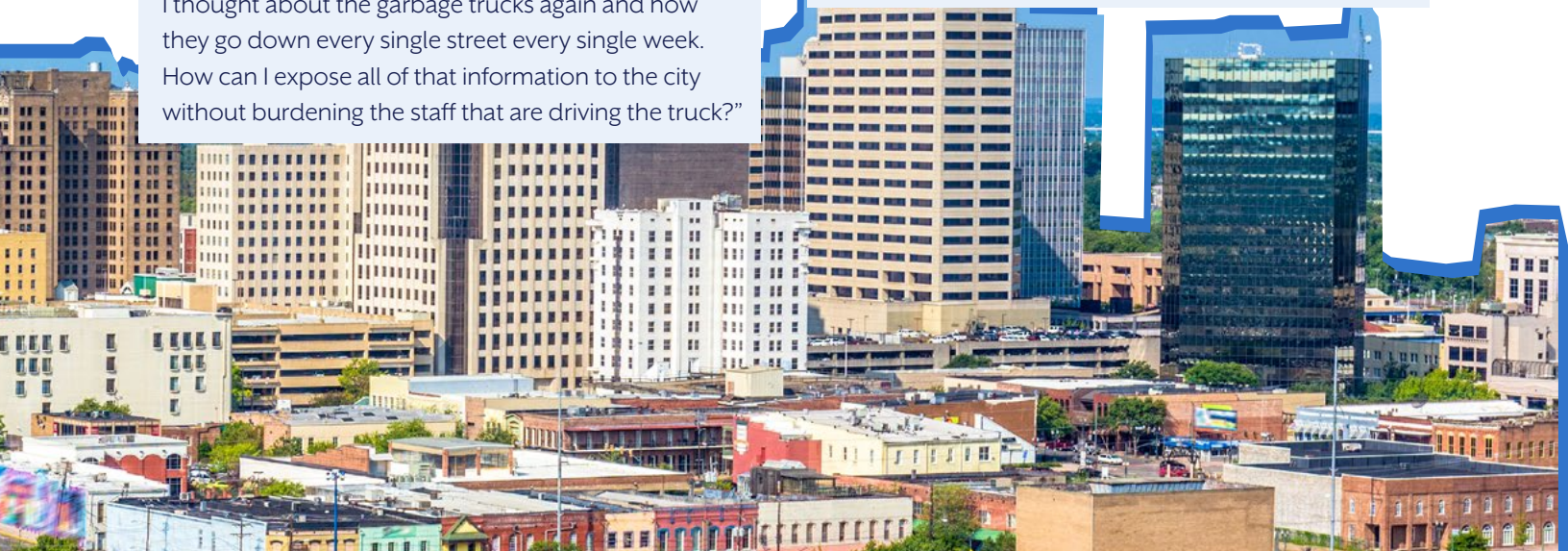
Open Source Government

Better yet, this approach is something that other cities can replicate. Shreveport used simple, inexpensive hardware components and is making its custom code open source so that other developers can test, use and even improve it.

> "That is why I'm so excited about open source in government. We could potentially get contributions back to our code base. And citizens may be able to deploy something like this themselves and help their governments. We've already heard one city, they got approval from their city manager – once we sent the source [code] to them, they've already been approved to buy, set up and deploy our Wi-Fi systems on their garbage trucks."

Hanson believes that this same mindset could apply to a wide range of projects as a way to fuel innovation.

> "A lot of these other projects that are off-the-shelf, they're complicated. Our goal has been to keep it as simple as possible, to build the source code to work. That's what we need. We need it to work. It doesn't need to look sexy. It doesn't need to look like it could be in a package somewhere. And so once I started seeing that we could build things and they worked, I realized this stuff could really change the way we operate here."

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The Year of....Automating Infrastructure

An interview with Abby Kearns, Chief Technology Officer, Puppet

In today's IT environment, the management and operations of infrastructure can be soul-crushing work.

The problem is that the traditional data center continues to evolve. First, agencies moved into a hybrid IT environment, with a mix of on-premises and public cloud solutions. Now, a growing number of agencies are going cloud-native, adopting microservices, containerization and serverless applications.

Given this dynamic environment, the IT team can easily get overwhelmed. While the IT environment has continued to expand with new technologies, the IT team has not.

"You really have to automate in order to operate at that scale, to be able to accomplish the work you need to do," said Abby Kearns, Chief Technology Officer for Puppet, whose solutions bring a DevOps-like approach to infrastructure automation.

The goal, she said, is to automate the rote activities and processes involved in infrastructure operations and management that are essential but that do not require critical thinking.

In an interview with GovLoop, Kearns discussed some of the key benefits of infrastructure automation.

Intelligent Compliance Enforcement

IT teams that rely on a manual, checklist-based approach to enforce compliance with regulatory, security and internal policies will get overwhelmed as their agencies move into a cloud-native environment, given both its complexity and scale.

That is why compliance enforcement is one of the best use cases for infrastructure automation, Kearns said. With the right platform, agencies can verify and enforce compliance in real time as the environment evolves – both improving compliance enforcement and relieving the IT team of countless hours of work.

Security at Scale

From a security perspective, a traditional IT environment is relatively simple, involving a limited number of applications running on a limited number of servers. A cloud-native environment, which can involve hundreds of thousands of containerized applications, poses a much greater challenge.

Agencies need to ensure that they have continuous visibility into the environment, with the ability to apply security in real-time as the infrastructure evolves and grows, Kearns said.

Agencies also should look for a platform that supports key standards and frameworks, such as the security and privacy controls cataloged in NIST Special Publication 800-53 or in the Defense Department's Security Technical Implementation Guides (STIGs).

Automation as a Journey

To be successful, agencies need an automation platform that fits into their existing workflows and systems, rather than forcing the staff to adopt a whole new set of tools, technologies and protocols, Kearns said.

That means it should integrate with the cloud platforms, operating systems and network resources that make up today's common hybrid infrastructure. It should also provide dashboards, collaboration tools and other capabilities that agencies can adapt to support and strengthen their existing processes.

Finally, the platform should enable agencies to learn as they go. Automation is not an end-state but a discipline, and an agency's strategy should evolve as its needs evolve.

"This remains part of our core vision at Puppet: How do we integrate well with the work you do today, and then scale with that journey over time?" Kearns said.

Beyond IT Modernization: SSA Plans *All-of-Agency Modernization*

An interview with Sean Brune, CIO and Deputy Commissioner, Social Security Administration

In a well-oiled machine, one spinning cog leads the others. This is the ideal image of what it looks like when an agency, such as the Social Security Administration (SSA), can align IT and business so that modernizing one area naturally modernizes the other.

SSA CIO and Deputy Commissioner Sean Brune said that the agency's key initiatives focus on the common goal of improving services for the public – and that's not just a technology effort, but an all-of-agency effort, Brune said.

In an interview with GovLoop in December 2020, Brune elaborated on what it looks like to have all the cogs aligned, oiled and spinning – in other words, how business and IT work together to help modernize the whole agency and iterate better services for the future.

Emerging Tech and IT Modernization

Integrating emerging tech adoption and IT modernization strategies is part of SSA's all-of-agency modernization efforts. To Brune, having up-to-date knowledge of the tech marketplace is crucial, so that as the agency modernizes its IT infrastructure, it builds "to the future, not the past."

"We see [emerging tech and IT modernization] as bidirectional. We have plans, but we have to update our plans based on changes in technology, changes in our business environments, changes in our priorities. Modernization, or improving the way we do business, is the agency's priority."

Being Picky About Emerging Tech

Still, joining emerging tech and IT modernization doesn't mean agencies should adopt any shiny new thing that comes out of the marketplace. For SSA, it's about making IT choices for modernization efforts.

"We do thorough market research when we identify capabilities that are new to the market or different from what we use. We generally explore them through a process we call technology incubation. [We] dig in to see the technology work in our IT environment in an isolated instance to evaluate how it might apply to our business purpose.

"The objective is not just [for] familiarity with the technology, but an early assessment: Is the technology compatible with our business needs and technical environment? If so, then we engage with our partners across the agency to evaluate how such a technology might help us meet our objective of improving service."

Getting Generous with Input

To improve service, receiving feedback is paramount. Employee input has been part of the agency's modernization journey from the start, Brune said. For example, input from frontline employees and vendors informs the technology incubation process, and employee feedback has directly driven many of the agency's improved services.

> "One thing we have implemented is online registration for Medicare Part B — that's a form that has to be completed [for benefits]. ...That form pre-pandemic was largely submitted by paper for an in-office interview. We provided a fillable electronic signature form on our website and allowed the public to complete and submit it via a web browser, or by filling it out by hand and faxing it. In that case, we used an e-faxing capability on the employee side to route the form to the correct technician for processing.
>
> "That electronic fax capability – desktop faxing we call it – is also an employee-driven improvement. That's enterprisewide now, where our technicians can send and receive faxes using their personal computers to not only claimants, but our business partners as well."

The agency receives input through multiple avenues such as crowdsourcing, focus groups and an open "idea box." Kim Baldwin Sparks, Chief Business Officer for IT Modernization and Digital Services, works closely with the IT department to organize feedback from employees organizationwide, Brune said.

> "Employees in different position descriptions and job responsibilities have helped to inform how we address problems, opportunities and needed improvements. We organize all our input into these categories: [Here's a] problem, here's an opportunity and here's a need for something that doesn't exist. ... Once we get that input from the chief business officer, we inject it directly into product development teams."

Becoming All-of-Agency Agile

COVID-19 has proven that agencies such as SSA can modernize and iterate faster than they usually do. In 2021, the focus is to build on this momentum to improve services agilely at full throttle.

> "Technology is an enabler, not a limiter. We want to serve the public the way they prefer to be served and in the manner they're accustomed to completing their business with other entities. So, our focus has been on becoming more agile, not just in our software development, but in our adjustment to new technologies and new business needs. The pandemic...year has proven we can rapidly iterate from one technology to another."

4 Take-Aways for 2021

If 2020 has taught us anything, it's that the past is not always a reliable basis for predicting the future, especially when it comes to IT. Without a doubt, the coming months will bring unforeseen events, policy shifts and new technology developments that will force agencies to rearrange their priorities.

That said, we'd like to close with four lessons about the use of IT that are likely to hold true whatever 2021 brings.

Keep it real.

Do you want to make a compelling case for the adoption of cloud computing or digital services? Show how they could help your agency respond to a crisis like a pandemic. That's one way to hit home with executive leaders or city council members who may not be tech-savvy.

In the future, even without another crisis of this scale, IT leaders still should focus on talking about technology in terms that make sense to everyone.

Focus on pain points.

Every technology exists to solve a problem, but not every problem is of equal importance. If you want support for an emerging technology, show how it can address your agency's most pressing pain points. The more pressing the problem, the likelier you are to win converts and get funding.

"Our city doesn't need a whole bunch of amazing, leading-edge stuff from vendors that will cost an arm and a leg. We really need to do the basics, and then innovate on those basics."

– Keith Hanson, CTO, Shreveport, Louisiana

"If you're implementing tech for the sake of tech, you're doing it wrong. The question is, does that technology solve a business need?"

– Duane Schell, CTO, North Dakota

Right-size your ambition.

When launching an IT initiative, it's tempting to aim big. But as we heard from Shreveport CIO Hanson (see interview, p. 20), it's often better to start with the basics and build from there. This approach has several advantages. First, it makes it easier to deliver results – at least some initial results – without having to make a case for a big budget outlay.

The start-small model also can serve as a real-life proof-of-concept, providing an opportunity to test ideas before requesting more money.

Don't gamble on security.

As noted in this report, the potential cost of not investing in cybersecurity steepens all the time. Perhaps no one in your organization will fall for a phishing attempt. Perhaps the security team will never miss a security patch or upgrade. But if they do? Whatever your role in IT programs, advocate for security.

In closing, we offer this final piece of advice, from the TV character Doctor Who: "If everything goes wrong, do what I do: Hold on tight and pretend it's a plan."

Further Reading

Analytics

The Federal Data Strategy: In line with the Federal Data Strategy, 19 agencies have taken initial steps to identify the data needed to answer priority questions, according to a recent report.

State CIOs' Top 10 Priorities: State CIOs rank data management and analytics as their sixth highest priority for 2021, according to the latest edition of NASCIO's annual list. That covers data governance, data architecture, predictive analytics and related topics.

Open Data: Since 2018, federal law has required agencies to publish information as open data and to develop comprehensive data inventories. However, according to a recent report, the extent to which agencies regularly update their data inventories is limited.

Artificial Intelligence

The White House Weighs in on AI: The age of AI has arrived, and it is transforming everything, according to this report from the executive branch. With that in mind, AI investments are now prioritized in agency budgets and coordinated across the federal government, the report notes.

Putting AI into Practice: The government's AI Center of Excellence is helping agencies overcome challenges to AI adoption to accelerate implementation of these transformative tools, this report says.

Fueling AI with Quality Data: Governments seeking to harness the power of AI must have access to high-quality data in order to analyze specific operational needs. According to one survey, only 45% of developers agreed that government data was clean and accurate, and less than 35% of developers thought government data was well documented.

Cloud Native

IT Efficiency: A "lift and shift" approach to cloud migration might actually increase an organization's overall costs of maintaining its systems, according a DHS OIG report.

Cloud Native Rising: Cloud-native tech will power digital transformation strategies in 2021. By the end of the year, 60% of companies will leverage containers on public cloud platforms, projects Forrester.

State of Development: The number of cloud-native developers in the world has risen to 6.5 million, up 1.8 million since June 2019, the Cloud Native Computing Foundation reports.

Zero Trust

NIST SP 800-207: In its special publication "Zero Trust Architecture," NIST explains the solution to security challenges related to remote users, bring-your-own-device policies and massive cloud computing.

Why zero trust?: To speed cloud adoption, resolve technical debt and improve mission attainment, according to report titled "Why Agencies Should Make Zero Trust Their Mission," from the American Council for Technology and Industry Advisory Council.

The Building Blocks of Zero Trust: Enterprises must provide secure access to IT resources from any location, while protecting interactions with partners and shielding communications. NIST's "Implementing a Zero Trust Architecture" can help.

Edge Computing

"The Edge Completes the Cloud": Edge computing moves processing closer to data generation, offsetting limitations of centralized computing, such as latency, bandwidth, data privacy and autonomy. Learn more in this Gartner report.

Networking at the Edge: In this podcast, renowned computer scientist Victor Bahl shares his views on edge computing, the intelligent edge and why they are important.

Transforming Government at the Edge: Edge computing accelerates decision-making and mission attainment. This report looks at putting data into the hands of deployed warfighters, medical professionals and first responders.

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