Trend 1

Stack Strategically:

Rearchitecting government for what's next

FEDERAL TECHNOLOGY VISION 2021

Accenture Federal Services

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A new era is dawning for today's federal enterprises—one where the strengths and capabilities of their technology architectures define more than ever how they execute their mission. To succeed, agencies will need to think about technology differently, making their business and technology strategies inseparable if not indistinguishable. In short, the agency's technology architects can no longer be supporting cast—increasingly, they are feature performers from a strategic perspective.

Enterprise success and failure increasingly hinges on technology architectures

Amazon's business strategy uses low costs, vast selection and fast delivery as an often-unbeatable competitive differentiator. The company had long invested in a technology architecture to deliver upon this value proposition. When the COVID-19 pandemic shifted the nation to online shopping in an unprecedented way, the company was able to continue to scale its business to meet skyrocketing demand with the world's largest retailer growing an incredible 37 percent and adding over 250,000 employees in 2020.[1]

Amazon's success underscores the extent in which technological capabilities can both define and embody an organization's strategy. It also reinforces the value of enterprise agility achieved through digital transformation. In contrast, some state governments were forced to call for volunteers with COBOL programming skills to help update their unemployment systems to meet a surge in applications.[2]

While enterprises anticipated this shift to digital, many of them miscalculated the speed in which it would arrive. As a result, few actually approached their technology and business strategies as one. Now, that's all changing. In response to the COVID-19 pandemic, companies and government agencies alike made rapid digital transformations, accelerating their journeys to the future.

But as enterprises modernize at pace, they are realizing all too well that technology is no longer one-size-fits-all—there are far more commercially available technology options than ever before and the choices they make today can radically alter their value propositions for tomorrow. From the distribution of cloud deployments, types of AI models, and wide range of edge devices, to the design, or even basic physics, of hardware and computation—each layer of the stack is expanding into new dimensions. The abundance of "as a service" solutions, improvements in technology standards, and the proliferation of growing cloud foundations taking root across government make it possible for agencies to design and assemble stacks of technological capability customized to their unique mission and business needs.

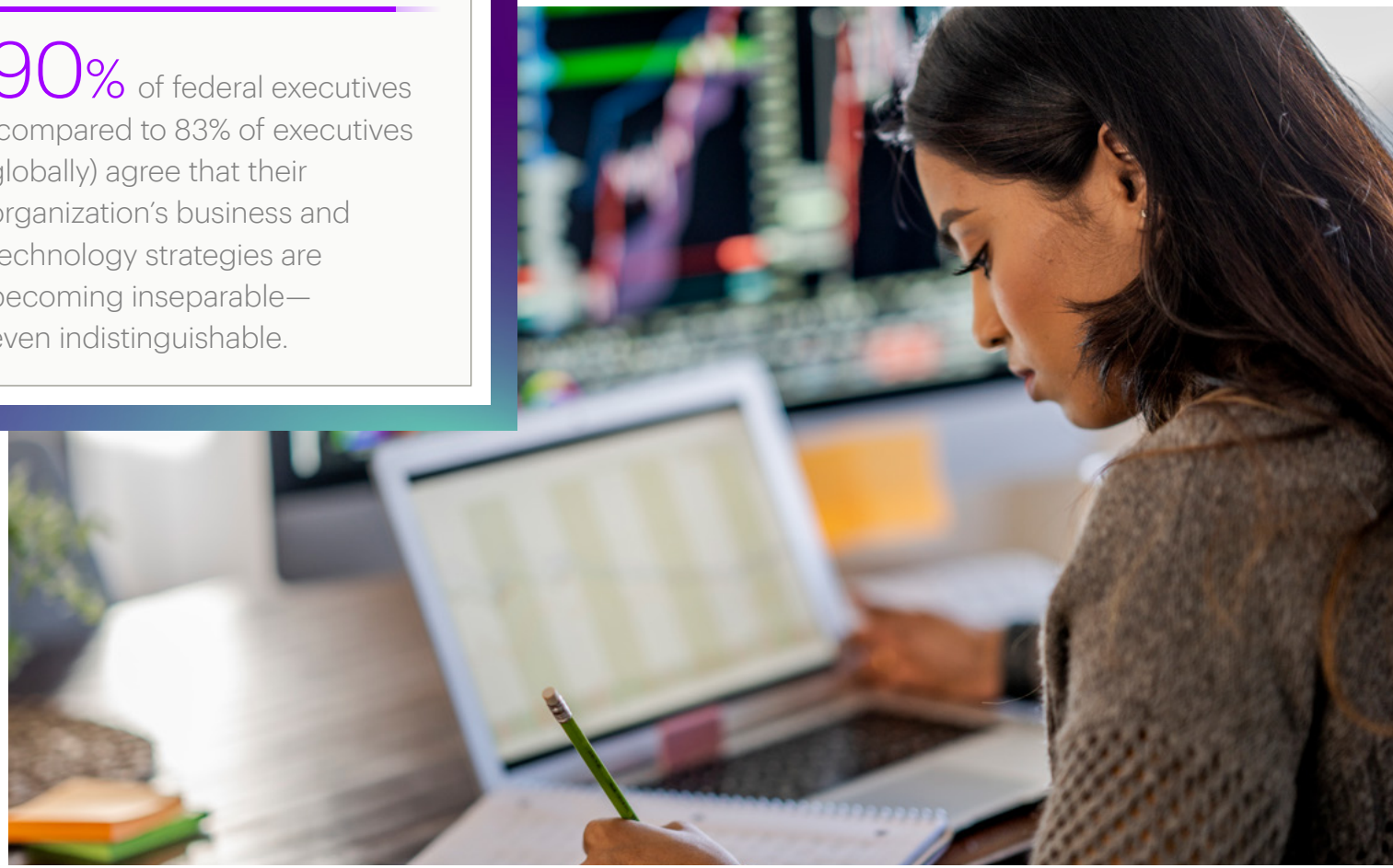
This range of options presents both opportunity and risk. The opportunity for government agencies is to tailor and optimize every layer of their technology architectures for mission success. The challenge is that many federal organizations remain encumbered by outdated infrastructures and are struggling to recalibrate their strategies and architectures to take advantage of this abundance of choice.

Government and commercial enterprises are now at a critical decision point. To achieve their mission and competitive ambitions over the long term, they must start designing and optimizing their technology stacks in a way that they can harness data and emerging technologies to become smarter, more resilient, more responsive, more efficient, and more capable in their day-to-day operations. As they make investments in cloud, data analytics, and emerging technologies, they will need to think about the long-term impact these choices may have—either limiting or propelling them in the future.

While the challenge of stacking strategically may fall to the CIO and other IT leaders in the agency, it is critical that mission and business leaders play an active role as well. They must educate themselves about emerging technologies and how they can propel the agency's mission and business operations so they can actively collaborate with IT leaders in making key architectural decisions. But they also must understand the strengths and constraints of their current architectures so they can leverage those capabilities effectively.

In this era where architecture matters more than ever, leaders will be decided not just on the success of their mission and business plans, but by the ingenuity of their technology choices.

90% of federal executives (compared to 83% of executives globally) agree that their organization's business and technology strategies are becoming inseparable—even indistinguishable.



The federal imperative to stack strategically

The government's mission needs change constantly. And as technology advances and information swells and accelerates, those mission needs adjust and grow more complex at an increasing pace. Congress regularly passes laws that change or create government programs. Industries continue evolving in their practices and technologies, requiring oversight agencies to keep pace. Complex national crises emerge and morph, forcing agencies to pivot quickly. To adjust successfully to these challenges, agencies require rapid, tailored, technology-enabled responses.

The problem is that many agencies today lack infrastructures that are sufficiently robust and versatile to meet the challenge. Their IT environments impede the rapid transfer and processing of data wherever it might be needed and the easy insertion of new technologies.

Agencies find themselves unable to quickly deploy new applications or adjust existing ones or scale them to accommodate expanding needs. Many struggle at incorporating automation and incubating emerging technologies like machine learning (ML) and artificial intelligence (AI) to make their operations faster, smarter, and less expensive.

These challenges bring the concept of *technical debt* to the forefront. Technical debt refers to the constraints created by deferred technology modernization. This leaves many federal organizations working *around* their IT infrastructures to accomplish mission objectives. Instead, federal agencies need to build *technical wealth* where it becomes an asset by establishing a clear path to move away from static, unadaptable legacy systems and towards living systems that continuously evolve and adapt to changing requirements.

Only 30% of federal executives say that technology drives their organization's overall strategy and goals.

Viewing architecture as strategy

So what does stacking strategically mean in this context? First, it means ensuring that the agency is thinking strategically about technology and data and that it has developed a clear sense of how to weave technology and data into its organizational DNA. This is where the military finds itself today with the development of its Joint All-Domain Command and Control (JADC2) concept.[3] And across government, this process must include educating mission and business leaders to the strengths and constraints of the current architecture, including the possibilities and opportunities inherent in it.

All of this may require that we reimagine the role of the enterprise architect (EA) to start. Historically, the EA was entrusted with ensuring technology investments supported the mission and were sustainable. The challenge is that they often lacked real-world authority to implement their enterprise-wide vision. Without an effective EA program, agencies can find themselves mired in technology sprawl—with an incongruous aggregation of disparate, domain-centric infrastructures—that slows or even conflicts with the agency's broader technology ambitions.

Today's EA needs to adapt more readily to the demands of "living systems" that are continuously evolving with added functionality and managed as "products" with defined lifecycles. These systems will increasingly rely on self-learning AI and distributed edge computing operating across a highly-fluid multi-cloud environment with hundreds or thousands of third-party managed services and platforms. With all of this occurring, there is a growing need for a single function within the enterprise to manage that complexity and ensure it is aligned with and serves the agency's larger goals.

87% of federal executives believe that their organization's ability to generate business value will increasingly be based on the limitations and opportunities of their technology architecture.

There are challenges aplenty (but don't let those stop you!)

Everyone knows it's hard to upgrade an airplane while it's flying. So how do agencies start stacking strategically when they already have expansive, heterogeneous IT environments in place, comprised of both modern and legacy systems, that are critical to the agency's operations? And how do they transition from a position of technical debt to one of technical wealth?

The U.S. Department of Education's Office of Federal Student Aid (FSA) overcame these challenges when it modernized a mission-critical suite of applications that process federal financial aid for those seeking postsecondary educations. These efforts reflect FSA's commitment to benchmark itself against leading commercial financial service providers. It realized that only by decoupling its applications from a mainframe environment and moving to a more modern architecture could it deliver a more consistent user experience across multiple channels and employ emerging technologies, such as AI-enabled chat bots, for improved customer service.

To achieve this vision, FSA re-architected a suite of mainframe-based applications—collectively known as the Common Origination and Disbursement (COD) system—to a fully automated, modern technology stack hosted on a FedRAMP-authorized cloud service provider, AWS GovCloud.[4]

The results speak for themselves. COD applications more than doubled from 40 to more than 80, and test environments grew ten-fold, from four to more than 40—all due to the use of automation, containerization, and a flexible cloud architecture. To accommodate frequent architecture and application changes arising from new legislative requirements or business-driven enhancements, a fully automated DevSecOps platform supports continuous integration/continuous deployment (CI/CD) pipelines with new deployments occurring weekly during peak change periods.

Enabled by the DevSecOps model and an everything as code approach, the system architecture expanded to support new programs after the initial cloud transition. These focused on new patterns based on microservices with an API first approach for development. These scaled to include over 50 microservices providing data services for front ends to support borrowers and schools within the student loan process.

Transitioning COD from mainframe to cloud not only renovated the application's technology stack, it also drove the retooling and growth of its architecture, operations, and security teams. And this success has encouraged FSA to transition other core systems to the cloud as well—by the end of 2021, 60 percent of FSA's enterprise systems are expected to be running in the cloud.

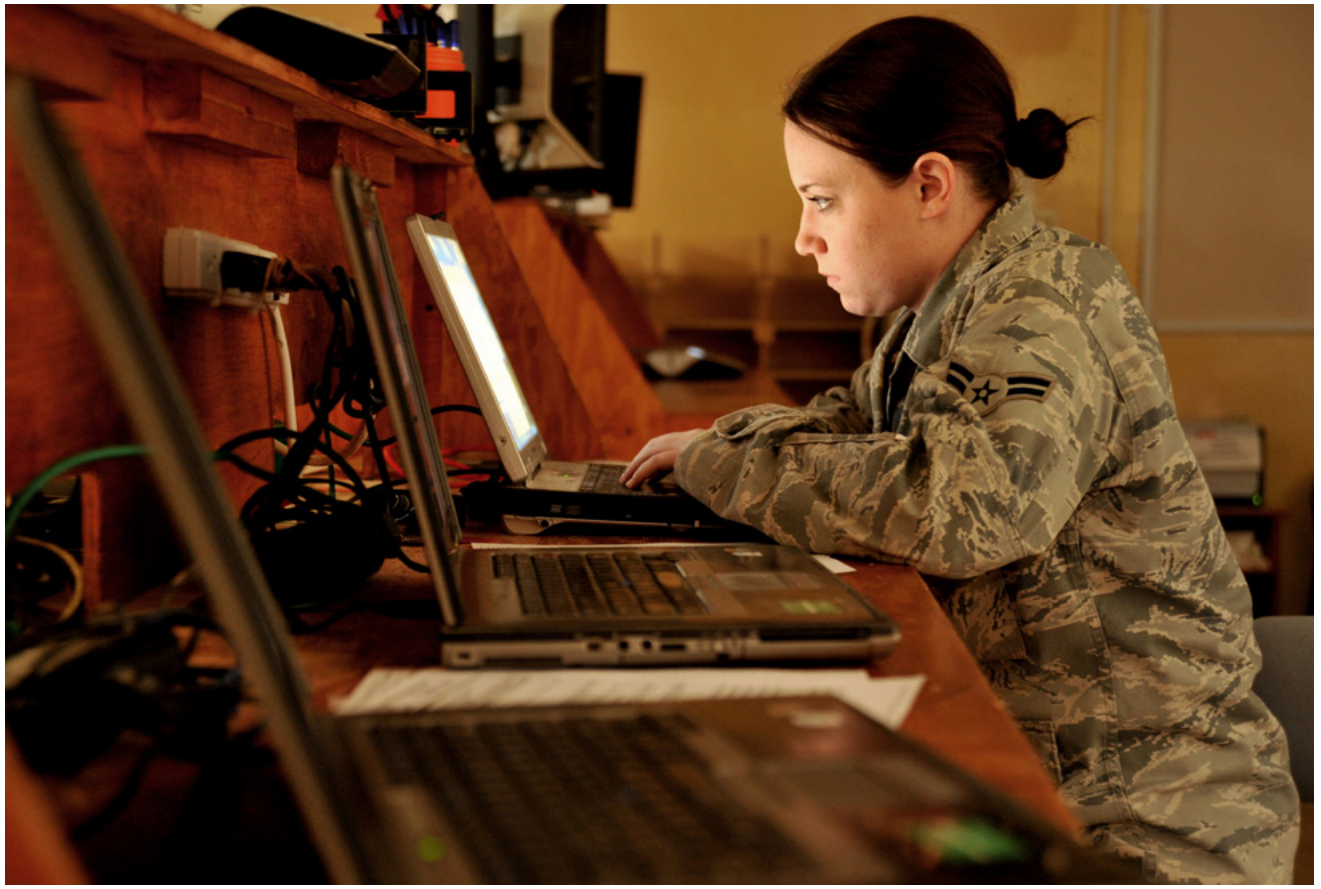
> **74%** of federal executives say their technology architecture is becoming critical to the overall success of their organization.

Explore further

Fortify:

Creating technical wealth

It is possible to reduce technical debt *and* build technical wealth at the same time, as FSA's example shows us. Specifically, a strategic approach towards digital decoupling—in which legacy systems evolve towards a modern architecture at a sustainable pace for the agency—can generate the cost-savings needed to help fund modernization.[5] This thinking is what spurred creation of the federal government's Technology Modernization Fund.



The appearance of U.S. Department of Defense (DoD) visual information does not imply or constitute DoD endorsement.

But another key take-away from the FSA example is that it is not enough to simply migrate applications to the cloud. When agencies "lift and shift" applications en masse to the cloud without also re-imagining the intended outcomes and the applications themselves to take advantage of the modern tools and capabilities the cloud offers, they are missing out on a huge opportunity that can have carry-over effects benefiting other applications and projects.

The emergence of these cloud-native architectures is poised to create a world of haves and have-nots across the enterprise landscape. Those that have embraced microservices, containerized, and serverless architectures to create more modular, plug-and-play applications can now innovate and adapt at digital speed. For example, the U.S. Department of Agriculture (USDA) is a collection of 29 agencies with nearly 100,000 employees. To create a more integrated, insight-led agency operating under one version of the truth, USDA implemented an API architecture using Mulesoft's integration platform that allowed it to consolidate operations within eight mission areas, maximize technology ROI through decoupling and reuse, and provide more integrated customer service.[6]

Just as with applications, agencies should likewise view their data as a huge opportunity to create technical wealth. This requires looking at your data assets through a broad lens and reimagining other potential consumers and purposes for that data. For example, how might your data assets add value when correlated with other data sets? What about making data more available to queries from agency stakeholders and other third parties or from a wider base of consumers within the agency or across agencies? Could connecting disparate datasets via APIs add greater functionality to existing applications? How will incorporating AI or ML layers into your data processing help position certain mission operations on a more proactive or even predictive footing. These are the questions that leaders should be asking.

The military services are reimagining their use of data. "The power in the data connected is something that Army senior leaders need," said Lori Mongold, chief of strategic operations enterprise in the Army Management Office.[7] To that end, the Army imposed a governance structure to promote more data sharing. It created an Army analytics board, an Army data board, and mission-area data officers focused on how to better leverage data to advance major mission categories such as the Business Mission, Warfighter Mission, Defense Intelligence Mission, and Enterprise Mission. Through these efforts, Mongold notes, "I see the gap closing between our ability to have a seamless data exchange and a seamless approach to the Army's ability to make more sound, risk-informed decisions, and defeat our adversary in a domain where we probably have lacked our ability to do that."

Another important point here is that stacking strategically can be done one step at a time. Don't try to boil the ocean. Establish an architecture, implement it incrementally, be agile throughout, and drive mission value while you're doing it, keeping a living systems mentality. In this way, you can deliver mission value very quickly. When you do migrate to the cloud, use an architectural approach instead of moving data or an application as-is and then re-architecting it later.

Extend:

Adding mission value through technology

With a technology foundation built for change, enterprises will unlock the true value of aligning technology and business strategies—tapping into today's wide range of technology options. The extraordinary array of technology capabilities emerging today is yielding far greater variety in business tactics and solutions. Enterprises no longer need to approach problems in the same ways everybody else does, and their unique technology solutions will be their edge in advancing mission success.

So how can agencies position technology to have a bigger impact on the mission from a strategic perspective? As we saw from the FSA example, one of the best ways to do this is by connecting the mission clients within the agency to the cloud. Increasingly, the real power of the cloud is no longer rooted in elasticity alone—it's also in the rich variety of tools that cloud service providers (CSPs) offer to develop and deliver innovative services. Most CSPs approved for government use, including AWS, Google, Oracle, and Microsoft, offer robust suites of tools and automated processes for developing, testing, securing, and deploying microservices and containerized applications.

In taking this approach, more and more agencies—such as the Homeland Security Department, the Treasury Department, and the CIA—are embracing multiple CSPs.[8] This multi-cloud approach has numerous benefits, such as creating greater parity; the opportunity to tap into multiple, best-of-breed platforms and applications; a lower reliance upon a single vendor; and limiting an agency's exposure to costly bid protests. But there may also be downsides, such as higher cost, the need for broader workforce skillsets, and proprietary barriers when performing operations across different CSPs.

It's important to point out that making the cloud—or even multi-clouds—available across an organization may not be sufficient. The client organizations charged with executing the agency's missions may not know what to do with all that capability.

This is where organizational adjustments can be helpful. For example, agencies should ensure their IT leadership—including the CIO, the CTO, the chief data officer, and the enterprise architect—are in alignment on the enterprise IT strategy and the need to build technical wealth across the enterprise. Also, empowering the enterprise architect within the agency and positioning it as a true adviser to the mission owners can help expose mission program teams to the art of the possible: How can edge computing dramatically transform the way agency operations are done today? What value can distributed ledger technology bring to the agency's financial operations? And how can AI and ML save our agency millions of dollars in maintenance and logistics costs or remove our case backlogs?

These are the types of questions and conversations that can be occurring when the EA is aligned more tightly with the mission side of the agency. An empowered, centralized EA function also would help ensure the agency benefits from operational synergies through the sharing of tools, data, managed services, resources, security, and applications.

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Considerations when re-architecting

Enterprises increasingly will be moving toward multi-cloud environments, so agencies will need to architect accordingly. For example, if an agency has multiple cloud vendors, it will need to think carefully about where it stores its data and where it processes that data because it may be impractical to store a large dataset in one CSP and process that same data in another CSP. These considerations revolve around the concept of *data gravity*. Data doubles roughly every two or three years—at this growth rate, data quickly becomes immovable in a practical sense, requiring compute and processing capabilities to be proximate to the data. This emphasizes the growing need for edge computing in the future—and architectures will need to accommodate that shift. In fact, around 10 percent of enterprise-generated data is created and processed outside a traditional centralized data center or cloud, according to Gartner. By 2025, Gartner predicts this figure will reach 75 percent, in part because of the proliferation of maturing IoT solutions and 5G connectivity.[9] The lesson here is that, too often, agencies place a lot of focus on their applications architecture and migrating their apps to the cloud and not enough focus on their data architectures—and that oversight could leave them in a bind.

The U.S. Postal Service exemplifies this trend. The agency was already using AI for address resolution within its mail handling system. However, processing 230 packages every second across nearly two hundred distribution centers created latency constraints for more complex analysis of the 20 TB of imagery generated daily. By implementing a Nvidia-based computer vision system at the periphery of the network, the Postal Service could capitalize on existing imagery to locate lost packages. Estimates suggest that this new system can accomplish in twenty minutes calculations that previously would have required two weeks to complete, reducing the time required to locate lost packages from days to hours.[10]

Another trend shaping the way IT architectures are evolving is the changing nature of hybrid cloud, which is also driven largely by the data gravity problem. Traditionally, hybrid clouds have been thought of as cloud extensions of an on-premises data center. But because of the increasing need to bring processing power to the edge where much of the data is being generated, cloud service providers are offering clients the ability to extend cloud services to on-premises locations at the edge. AWS Outposts, Azure Stack Hub, and Google Anthos are examples of this.

In general, data is becoming an ever-larger concern for enterprise architects. They must work with their CDOs to develop a solid understanding of the data they are responsible for—where it resides, where it needs to go for processing, and the costs of egressing that data, if necessary—as well as the network bandwidth and latency considerations around that data transmission and then find efficient solutions to those challenges.

Reinvent:

A new generation of technology and business

One of the big payoffs from digital decoupling is creating distinct services that can be reused across multiple applications. In doing so, this functionality shifts from working within a known environment and context to operating more autonomously with less visibility into how it is being used. This means that we often need to take more proactive steps to ensure appropriate use, as what was once understood must now be made explicit.

Fortunately, government agencies are acknowledging the need for added responsibility, especially as it concerns AI and ML applications, which have attracted heavy scrutiny because of their potential to encode bias in their algorithmic models. A number of agencies, including the departments of Homeland Security, Health and Human Services, and Justice, for example, have issued AI strategies and policies that place a high priority on "responsible" or "ethical" AI use, but those strategies generally don't detail what that will mean in practice.[11] Responsible or ethical AI generally refers to a variety of steps that can be taken during the development and deployment of an AI or ML capability that aim to manage, monitor, and mitigate biases that may be intentionally or unintentionally embedded in the data being used.

Most agencies still have far to go in fleshing out protocols and steps that will enable them to design responsible AI systems and architectures in a systematic way. For example, a 2020 report by the Administrative Conference of the United States found that none of the numerous federal agencies it reviewed had established systematic protocols for assessing the potential for an AI tool to encode bias. "The upshot here, as earlier, is that developing internal capacity to rigorously evaluate, monitor, and assess the potential for disparate impact will be critical for trustworthy deployment of AI in federal administrative agencies," the report concluded.[12] Even the National Artificial Intelligence Research and Development Strategic Plan, issued by the White House in 2016, highlights the need to design architectures for ethical AI.[13] And while it describes a variety of considered approaches for doing that, the strategy leaves the challenge with individual researchers to figure out.

The Defense Department, which has been more aggressive than any federal agency in pursuing AI- and ML-enabled applications, has also been the government's pacesetter in adopting a responsible AI posture by formally adopting in 2020 a series of ethical principles concerning the use of AI. The recommendations came after 15 months of consultation with leading AI experts in industry, government, academia, and the public. The DoD's AI ethical principles apply to both combat and non-combat functions and encompass five major areas. For example, they require DoD personnel to minimize unintended bias in AI capabilities, employ methodologies to ensure the AI they are using is transparent and auditable, and maintain an ability to detect and avoid unintended consequences and the ability to disengage or deactivate deployed systems that demonstrate unintended behavior.[14]

Privacy and other ethical concerns follow many of the technologies emerging in the marketplace, not just AI. To help address this, the National Institute of Standards and Technology released in 2020 a draft privacy framework that sets an ethical foundation for data usage for technologies such as AI, biometrics, and the Internet of Things. "Getting privacy right will underpin the use of technologies in the future, including AI and biometrics, quantum computing, the Internet of Things and personalized medicine," said NIST Director Walter Copan. "These technologies all will be a big part of our future."[15]

While these steps are helpful, federal agencies in particular will need to give far greater thought to ethical considerations as they explore and expand their use of new technologies because of the highly sensitive nature of federal data and because of the government's significant impact on almost every aspect of our lives. In the case of AI, for example, there's a significant effort by DoD's Defense Advanced Research Projects Agency (DARPA) to flesh out how to make AI systems more understood and explainable to the people using them (as well as to others, such as courts and regulators that will have to make judgments about their efficacy, legality, and suitability).[16] This is a critical concern for many government agencies that operate in the law enforcement, medical, security, and other arenas.

Government agencies will need to develop a firm understanding of emerging technologies not just because they will need to evaluate them and use them—they also are increasingly being called on to regulate them as they proliferate across virtually every industry. Take distributed ledger technology (DLT), for example, which is being used or explored by a wide variety of industries—including finance, insurance, healthcare, agriculture, logistics, travel, and much more—to improve the transparency and veracity of transactions.[17] The Government Accountability Office called out the lack of regulation over DLT as a key challenge for some oversight agencies.[18]

The great diversity of technology capabilities available to government agencies and businesses today is creating limitless possibilities—but also new challenges. As agencies accelerate their innovation strategies to meet today's and tomorrow's mission demands, they need to be strategic—the technology choices they make today will have far-reaching impact. The architectures that federal agencies build today will determine their future.

Decision points

Fortify: Is your agency prepared to be a technology leader?

- Technology is reshaping the world and the government's place in it and this evolution went into overdrive in 2020. Revisit (or create) your vision for the future of technology by identifying what has accelerated, what has lagged, and what has changed forever.
- Evaluate current digital transformation efforts at other federal organizations and as well as at other state, local, and foreign government organizations that share similar missions with your agency. Accelerate investments in core technologies like cloud, data analytics, and mobility. Identify new avenues for digitally driven products, services, and customer experiences that leverage growing technology capabilities.

Extend: How are you creating an edge for achieving mission success with your technology choices?

- Focus on building technical wealth. Reimagine your approach to application development to take advantage of cloud capabilities, microservices, and the flexibility they unlock. Focus on creating reusable components that are maximally valuable, not just minimally viable.
- The future is here already. Begin piloting or scaling efforts and investments in next-generation technologies like distributed ledger, extended reality (XR), or AI to better understand how they can create new value for your agency's mission and business—and make sure you have a strategy for them.

Reinvent: How will your relationship with your agency's stakeholders be reshaped by next-generation technology?

- Conduct design thinking and strategic foresight exercises to evaluate how technologies can create greater value in those relationships.
- Make trust a core design principle of new technology strategies. Prioritize data privacy, ethical design, and continuous governance as you build and deploy new systems and services to promote trust and adoption among employees, citizens, and agency stakeholders.

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Exploring Tech Vision

For over twenty years, the Accenture Technology Vision has identified the most important emerging technology trends impacting businesses, governments, and society over the next three years. What sets it apart is its focus on the underlying forces behind each trend as well as the frank advice it offers on how enterprises should respond. The Accenture Technology Vision is produced by Accenture Labs and Accenture Research with input from over one hundred Accenture leaders and more than two dozen external experts. It also incorporates the findings of a global survey of over 6,000 enterprise leaders.

This year's global report, Leaders Wanted, examines how the world responded to the unprecedented stresses and challenges created by the COVID-19 pandemic. What we learned is that many enterprises are far more agile than they thought. Their challenge going forward is accelerating their digital transformation to meet the new expectations left in the pandemic's wake.

The Accenture Federal Technology Vision 2021 applies these trends to the unique demands and challenges facing the U.S. federal government. It builds upon insight from more than 50 Accenture Federal Services experts as well as survey data from two hundred federal program, business and IT leaders.

Readers can assess the accuracy and relevancy of our predictions for the federal government by reviewing last year's report. Key trends in the Accenture Federal Technology Vision 2020 included the I in Experience, AI and Me, the Dilemma of Smart Things, Robots in the Wild, and Innovation DNA.

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