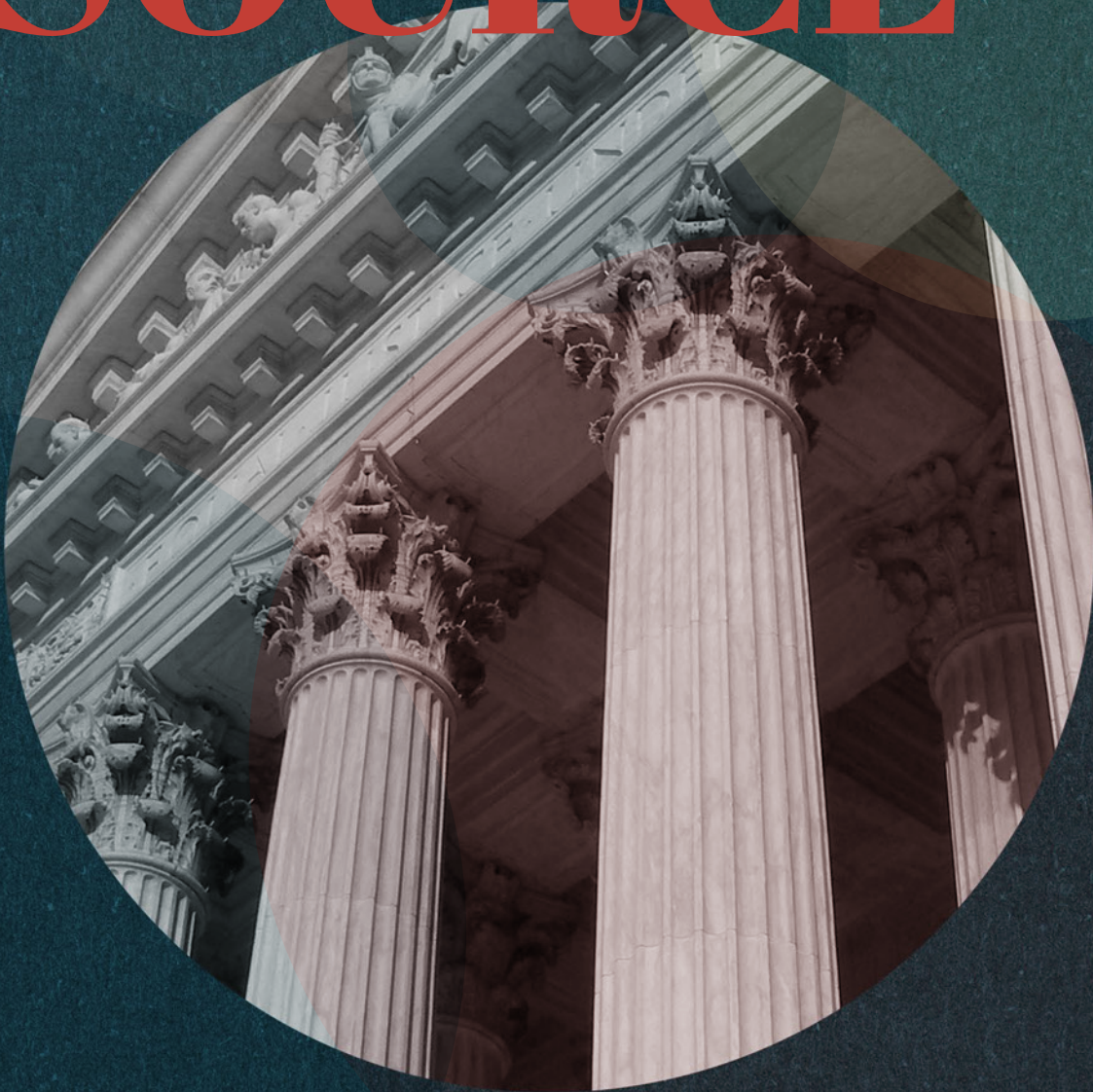# OPEN
SOURCE

THE FUTURE OF GOVERNMENT TECHNOLOGY

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Open Source Powers Government

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Foreword

In today's environment agencies are constantly challenged to do more with less. A common misconception of open source solutions are that they are not supported or secure. In reality enterprise open source technologies have a lot to offer the public sector, enterprise open source technologies combine the best of both worlds. They offer the innovation of a large community of developers with the support and security that agencies need.

Riding the momentum of President Obama's open government directive, agencies have realized that open source technology offers a bright spot in government innovation and holds great potential to reimagine business processes and how services are delivered in the public sector. Open source technology – a publicly accessible, collaborative process driven by meritocracy, where everyone is free to make improvements to source code of products – is changing government for the better.

Government agencies are using open source solutions in a variety of ways, including mission critical systems, powering websites and running internal communications platforms. We've seen how agencies can tailor open source solutions to fit organizational needs. And we've seen how the support and partnership of industry is helping public sector organizations take advantage of the benefits of open source technology in truly significant ways.

Open source technologies enable agencies to connect with communities of developers to increase innovation. Agencies should be aware of all of the possibilities, and be able to deploy open source solutions easily and quickly.

We believe that a continued foray into open source technology is not just possible; it's imperative. And we're committed to helping government agencies approach the future with bold confidence.

Natalie Gregory,
 Vice President, Carahsoft

Contents

Executive Summary

The terms "open" and "government" traditionally have been mutually exclusive. But that's started to change. Today public officials at the federal, state and local levels recognize that to truly be a government of the people, by the people, and for the people, they can't operate in a closed, siloed environment.

As officials search for ways to increase capabilities, transparency and citizen engagement while decreasing spending, one solution is continuously bubbling to the top: open source technology.

At its core, open source technology involves software whose source code can be freely viewed and edited. Its top advantage to government is that it enables agencies to find one solution to common challenges and to replicate that solution as often as needed – without a hefty price tag. It's simple: If the information is there for the taking, there's no need to spend taxpayer dollars on reinventing the wheel.

As a result, open source is helping speed up traditional government operations. Instead of multiple agencies spending time, money and human resources to create the same technological programs, now they can browse the repositories of their peers' source code and pick up what applies to them. What's more, they can edit the code to add features and then share with others to use or amend again.

In this guide, we will look at why open source approaches are good for governments at all levels. In the coming pages, you will find:

- Interviews with open source experts such as Ben Balter and Code for America Chief Technology Officer Michal Migurski

- Six case studies of federal agencies using open source successfully

- Three case studies of state and local governments using open source to make residents' lives better

- Forecasts on what to expect from open source in 2015

- An elevator pitch for you to use in urging open source adoption at your organization.

The Current State of Government Open Source

L ast August, General Services Administration Chief Information Officer Sonny Hashmi instituted a policy requiring that open source solutions get top consideration for new IT projects. "Simply put, any solution developed using taxpayer dollars should be in the taxpayer's domain (open source)," he wrote in a blog post. "At GSA, we believe that all code we developed should be shared under an open license so others may benefit from it. In addition, we will give priority to using open source software as we design now solutions."

The White House has issued policies and guidance related to the development of a more transparent, participatory and collaborative government, which also means deploying open source tools. Here are some examples:

THE OPEN GOVERNMENT INITIATIVE

On his first day in office in 2009, President Barack Obama signed the Memorandum on Transparency and Open Government, which pledged to empower the public and increase financial openness.

THE DIGITAL GOVERNMENT STRATEGY

Released May 23, 2012, this White House document includes a three-layer conceptual model (information, platform, and presentation), followed by four overarching strategy principals. Note that the conceptual model separates the creation of information from its presentation, so that data can be produced once, and then used in multiple ways. Among the four core principles: "A 'Shared Platform' approach helps us work together, both within and across agencies, to reduce costs, streamline development, apply consistent standards, and ensure consistency in how we create and deliver information."

DIGITALGOV.GOV

In response to the Digital Government Strategy, the General Services Administration's Office of Citizen Services and Innovative Technology established this website to "help agencies build a 21st century digital government." It has offered several webinars and posts on open source. Topics have included "Mobile Web Templates: How to Use Open Source CMS to Implement Responsive Web Design" and "Best Practices for Open Source in Government (Using GitHub)."

THE OPEN GOVERNMENT DIRECTIVE

Issued Dec. 8, 2009, in response to Obama's memo, this gave agencies timelines for establishing open government websites on which they must publish available data. It also directed agencies to create a culture of open government—requiring Open Government Plans that would improve transparency and public participation.

OPEN SOURCE SOFTWARE POLICY

On Sept. 24, 2014, the White House announced four new and expanded open government initiatives as part of its involvement in the Open Government Partnership, an international partnership to promote government transparency. One initiative has a component of adopting an open source software policy. "No later than December 31, 2015, the Administration will work through the Federal agencies to develop an open source software policy that, together with the Digital Services Playbook, will support improved access to custom software code developed for the Federal government," a report states. The Open Government Partnership has expanded since its launch, from 8 countries to 65 participating countries.

The White House is doing more than just talking about open source, however. It released some of the open source code it had developed in April 2010 – long before open source enjoyed the popularity it's amassed in the past couple years. In 2012, it established a presence on GitHub, an online code sharing and publishing site, and released the source code for, among other things, We the People, which lets citizens petition the administration to take action on issues. The goal was "to empower other governments and organizations to use this platform to engage their own citizens and constituencies," according to the White House.

Additionally, an open source content management platform called Drupal powers WhiteHouse.gov and many other government sites, including the Education, Energy, Commerce, Homeland Security and Transportation departments.

Still, open source is fairly nascent in many ways. Agencies are only now beginning to see not only its utility, but also its necessity.

"I think there's really three reasons that open source is finally becoming attractive to agencies: shrinking budgets, heightened scrutiny and higher expectations," said Ben Balter, Government Evangelist for GitHub. "Government agencies are realizing that open source is a mechanism by which they can get immediate feedback from the end users, whether those end users are internal or those end users are external. And all this happens before the first dollar is ever spent."

Let's step back for a moment and go over a few basics. Open source is defined as "something that can be modified because its design is publicly accessible," according to OpenSource.com, an online publication that looks at how open source is applied. "Open source software is software whose source code is available for modification or enhancement by anyone. 'Source code' is the part of software that most computer users don't ever see; it's the code computer programmers can manipulate to change how a piece of software — a 'program' or 'application' — works. Programmers who have access to a computer program's source code can improve that program by adding features to it or fixing parts that don't always work correctly."

What's more, open source software gives users more control because they can study the code for problems and easily make changes. But open source is more than code. The Open Source Initiative, the community-recognized body for reviewing and approving licenses according to the Open Source Definition, lists 10 criteria that must be met in order to call something open source. They include free distribution; no discrimination against people, groups or fields of endeavor; no specificity of a license to a product.

Open source must not be confused with open data, which is also getting a lot of attention. Open data is "data that can be freely used, reused and redistributed by anyone," according to the Open Data Handbook. In other words, open data is the output of a closed or open source system.

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The Option Value of Open Source Technology

An interview with Gunnar Hellekson, Chief Technology Strategist for Red Hat's Public Sector Group

A t one time, public sector technology initiatives had a very standard pattern for deploying new initiatives. Often, agencies would buy one computer, one storage solution, with all the associated hardware and software from the same vendor. The thing was, you need to make sure you really liked that choice – because that was the choice you were making for the next ten years.

Today technology deployments operate in a much different capacity, as many government agencies have turned to open source solutions as an essential part of their IT infrastructure. GovLoop sat down with Gunnar Hellekson, Chief Technology Strategist for Red Hat's Public Sector Group, to discuss how open source – especially when partnering with an industry leader – leads to innovation and choice for government agencies.

"IT lifecycles are getting shorter and shorter and technology is moving faster and faster these days," Hellekson said. "That's actually a good thing, because it gives the public sector more opportunities to make new choices. It makes sense to build an infrastructure that can accommodate that world of choices. And that's where open source technology comes in."

Hellekson pointed out that most of invention in cloud computing, mobile, and big data these days is from open source communities – groups of coders and developers who collaborate to improve upon source code and share the changes within the community so that other members can help improve it further.

"The vast majority of IT innovation is coming from the open source communities," Hellekson said. "And in order to take advantage of basically what's free research and development that's being put out by industry, the government needs to be able to use open source software. So it comes down to a choice between downloading it off the internet on your own, or getting it through a trusted provider like Red Hat."

Hellekson explained that downloading open source technology off the internet can actually be a great way to test new IT solutions. This is especially true if your agency has the staff that understands how to leverage open source technology, and how it can come into play for your technology roadmap.

"But most agency IT shops don't have the proper time and staff resources for open source," said Hellekson. "By partnering with somebody like Red Hat, you get the assurance of interoperability, because we partner with other hardware and software providers, all to make sure that our technology works together. Unless an agency can move at the speed of an open source project – which updates literally every day – most agencies are not prepared to keep up with the pace of the open source community. And so one of the big things that we can do is help with that."

Along with the stability and support that a partner like Red Hat can offer agencies using open source technology, Hellekson pointed out another valuable advantage – the ability to not be locked in to proprietary technology.

"If you choose a proprietary cloud platform, you're often mortgaging a lot of your future to a vendor who may raise prices in the future," Hellekson said, "or a vendor who may fall behind in terms of technology. If you have standardized on an open source option, you have an exit strategy for that platform. You can go find another provider of support services, you can go move to a different open source platform."

Hellekson explained how recently Red Hat worked with the Department of Defense to create a management tool for taking advantage of some of the public and community clouds that were available to them – while removing lock-in from any one provider.

"Now it's easy for the DoD to add a provider or remove a provider from their portfolio," Hellekson explained. "And if one provider is too expensive, they can go ahead and move that same workload to a different provider. This creates choice for the DoD. It also gives them an opportunity to build for the future, so that as new providers come online, or new technologies, it's easy for them to integrate it into their management system."

Though the ability to not be locked-in to any one vendor is often cited as a feature of open source technology, Hellekson said he prefers to think of it in a different way.

"I think it's more interesting though to talk about the term option value, which is kind of the flipside of lock-in," he said. "Option value means you use open source to make your agency more available to innovation and new approaches. And that's why I think open source has been so preeminent. It's because open source is just a better way to make better software. That's what option value is."

Benefits of Open Source to Government

O pen source is not exactly the new kid on the block. Various distributions of the well-known Linux operating system have been powering computers with its open source structure since October 1991. Mozilla Firefox is an open source web browser that's been around since 2004. Today half a billion people worldwide use it, and about 40 percent of its code was written by volunteers, according to Mozilla.

Still, a 2013 GovLoop survey found that only 38 percent of 233 government workers polled were using open source at a basic level, and 30 percent are not using it at all. Only 20 percent said they rely on the technology to meet agency goals.

Those numbers are likely to change. Last year was a particularly important one for open source at the federal level.

THE U.S. DIGITAL SERVICES PLAYBOOK

Issued in September 2014 by the CIO of the United States, this is a how-to for standing up open source. It provides 13 "plays," or steps, that all levels of government can follow in implementing open source initiatives.

THE U.S. DIGITAL SERVICE

Launched in August 2014, USDS is "a small team made up of our country's brightest digital talent that will work with agencies to remove barriers to exceptional service delivery and help remake the digital experience that people and businesses have with their government."

18F

Open source is fundamental to all the projects that this startup within GSA tackles. Since March 2014, it's been partnering with agencies to deliver digital tools and services and abiding by a liberal open source policy. (For more on 18F, see page 15.)

The benefits of open source to government are driving these pushes, Balter said.

"The ethos of open source and the true advantage is in solving the problem once and solving the problem everywhere," he said. "Unlike Coke and Pepsi, where there might be an argument for keeping some secrets because if Coke publishes their mechanism, Pepsi doesn't have to spend money on that and it affects their bottom line, with the federal government, there's no competition."

But the government does reap financial benefits – and saves taxpayer money – by enabling developers to build something once and reuse it often.

Open source is especially beneficial for state and local governments, said Michal Migurski, CTO at Code for America (CfA). Founded in 2009, CfA connects developers and designers with government officials to improve services through technology. Everything CfA has delivered to governments has been open source.

"I think for municipalities in particular, they've been feeling the pinch really hard for the past couple decades," Migurski said. "Municipal budgets have been shrinking over the years. It's been hard for them to prioritize technology, and they're also at a small enough scale where they can't always build enterprise-class things on their own."

CfA offers them an "escape hatch," he added, in terms of making smaller, nimbler and more purpose-built things available to them, and offering them an alternative to traditional approaches.

State and local governments have an opportunity to set an example for open source use in the federal government. "Our theory of change at Code for America is that the small folks set the tone for the big folks," Migurski said. "The federal government will do things when it sees the states and before them counties and before them cities do things."

> **"It's still a little bit of a long road for government to start to see the ways in which open source doesn't represent a risk but an opportunity."**
> *- Michal Migurski,*
> *CTO at Code for America*

SOME CHALLENGES

Government has a reputation for being stuck in tradition and bureaucratic red tape, preventing it from keeping pace with innovation in the private sector. A few factors contribute to this.

One is government procurement, which is still based on customary purchasing methods that don't apply to open source, Balter said. Spending years specifying requirements and hashing out a multimillion-dollar contract leaves the government without a single line of code until the end product is delivered. This is known as the waterfall approach to software development.

"A lot of this is just procurement by habit," Balter said. "Oftentimes in government we like to think that because we've been doing something a certain way for so many years, it has to be law or policy."

But open source needs an iterative, agile process to thrive, and change is hard, which is why getting stakeholder support is so important to the success – or even the initiation – of open source projects.

"It's not a question of whether government can do open source, whether they can use open source, whether they can publish open source," Balter said. "They know how to publish a GitHub repository, they know how to write a WordPress plug-in or whatever it might be. The challenge is cultural. There's a lot of fear."

That's especially true at older agencies, he added, where workflows and processes established during the Cold War are still in use. Newer ones, such as the Consumer Financial Protection Bureau, have more room to experiment. (See case study, page 16.)

"I think in the private sphere, especially in the past 10 years, open source has moved into the prominent position as far as any kind of web or network technology," Migurski added. "Government can see that, but at the same time there's still a trust issue there.... It's still a little bit of a long road for government to start to see the ways in which open source doesn't represent a risk but an opportunity."

To remedy this, the gap between what Balter calls "geeks" and "suits" must be narrowed. To do that, CIOs, secretaries and other executives should reach out directly to developers at their agencies to find out what they would like to work on.

"The analogy I like to use is if you want to know what the next big thing is in medicine or how you should be taking care of yourself, you'd look at your doctor and you'd say, 'Hey, do you take a multivitamin? OK, you take a multivitamin that's good enough for you, I should probably take one as well,'" Balter said. "There's a similar lesson to be learned in government."

Overall, he sees great promise in governments' use of open source moving forward. Balter likens it to the emergence of past technological advancements.

"It reminds me a lot of a state three, four, five years ago when social media was just getting popular in government, when people realized that they could use Facebook and Twitter as public engagement platforms, and that's a worthy means of accomplishing agency mission," he said. CIOs and higher-ups didn't know Twitter and Facebook per se but knew the agency needed a presence. "I think we're getting that same source with open source, where CIOs are saying, 'Are we on the open source? We should be on the open source.'"

Many are getting on board. Govcode, a website that provides an inventory of government open source projects, has a list of 970 agency repositories. We'll take a look now at six of them plus three interesting state and local government uses of open source.

Building a Bridge to a Great Open Source Environment

An interview with Marc Linster, Senior Vice President of Products and Services at EnterpriseDB

T he success of open source software is about to be played out in the government sector as it did in the private sector. Companies found success first with Linux for the operating system, then advanced to solutions like JBoss for the middleware layers. Now, global brands are looking to replicate the success of open source in the data center, where the database remains one of the costliest pieces of software in the organization.

Government agencies have taken note and are seeking to achieve the same success with open source solutions in the data center.

Governments can now, with the help of software like EnterpriseDB's Postgres Plus, rely on open source technologies to perform as well as if not better than commercial databases. GovLoop sat down with Marc Linster, Senior Vice President of Products and Services at EnterpriseDB, to discuss the changing technology trends and the increasing deployment of open source database solutions in the public sector.

EnterpriseDB believes the tide has turned for traditional software vendors and enterprises to continue to embrace open source. "The database is going through the same process of maturation as the operating system did in the past with open source," explained Linster. "Now, with Postgres as it stands today, enterprises and governments have a very reliable, very high performance database solution available to them."

For government agencies, EnterpriseDB offers Postgres Plus Advanced Server, which extends the open source PostgreSQL database management system (DBMS) with enterprise-class performance, security and manageability enhancements. With this solution, agencies can take advantage of the cost savings associated with open source without sacrificing performance. And because EnterpriseDB provides tools, training, support and professional services, organizations have the same support system provided by traditional vendors. Additionally, Postgres Plus Advanced Server can be deployed in a cloud environment and has been certified for AWS' GovCloud.

"EnterpriseDB has increased the performance of Postgres, has built in additional layers of security and developed management tools, all of the things that an organization requires when deploying a major enterprise

solution like a database," said Linster. "As a result of the work we have done, Postgres has become a viable alternative to expensive, traditional solutions."

Linster additionally explained that to facilitate the deployment process, EnterpriseDB also developed database compatibility for Oracle into its database. Government agencies using Oracle can migrate many workloads onto Postgres Plus and significantly reduce their costs without losing performance or the skills they've invested in over the years.

"We're taking the open source environment of Postgres and adding the capabilities that organizations need to ensure they are successful," said Linster. "In doing this, we're essentially helping create a bridge from the very expensive environments to a much more cost-effective alternative."

Linster noted today's open source database technology is at the tipping point where the software has advanced to feature the capabilities large organizations require and the commercial support for the software through companies like EnterpriseDB has reached a critical mass.

"There are enough proof points out there in the industry to show government and enterprises that the time is right to expand the use of open source technology beyond the operating system and into the data center," said Linster. "This is now happening in the world's largest corporations and government agencies. Deploying open source databases is now absolutely a best practice for the CIO.

Industry analysts have recognized that open source databases have achieved a place in the enterprise software environment. Recently, Gartner positioned EnterpriseDB in the Leaders Quadrant in the 2014 Gartner Magic Quadrant for Operational Database Management Systems.

"Postgres has now achieved a level of maturity and capability where it can easily handle the majority of workloads at most large organizations," said Linster. "And we ensure that public sector agencies have the support and services they need to ensure success and minimize risk."

Six Federal Open Source Use Cases

NASA

NASA

The space agency is a bastion of technology, so it's not surprising that open source has been on its radar since 2000. The first program to use it was the Mars Exploration Rover, which sent two robots to the Red Planet in 2003. That same year, the agency released the World Wind program, an open source virtual 3-D globe that lets users zoom from satellite altitude into any place on Earth. Developers can embed the program's technology into their own applications.

"Open source has always kind of been there, but I've seen a trend toward more and more folks being motivated to release open source than have been," said Jason Duley, Open Innovation Software Lead at NASA Ames Research Center. "We're entering a new era of open source, in my opinion."

NASA has a few repositories: SourceForge, GitHub and NASA sites that host source code, such as Code.NASA, which launched in April 2014 and lists more than 1,000 projects. Some start as open source, and others are opened after the fact.

NASA's process for opening them varies by field center, each of which has a Software Release Authority that is responsible for vetting projects. For example, say agency developers write a web utility that shows the location of the International Space Station using data from an internal source, Duley said. They decide to publish the code on GitHub, minus the internal information. Outside developers could fork, or copy, that repository and apply different data feeds to use it or add features. Then, a different "branch" of the repository would exist that NASA could integrate into internal use.

At NASA, open source has two elements – internal and external sharing – and both come with challenges, said Beth Beck, Open Innovation Program Manager in the agency's Office of the CIO.

"We'll have a specific mission and the people working on that mission will create whatever they need to make their mission work, and so it's very siloed and your software may be specifically written for the shuttle program or for the rover," she said. "The inefficiency is that we're writing things that might be the same thing we need for another program, but because we're not speaking to each other about it, we just have our heads buried into making sure the program flies and it works and all that. Open source is a way of letting the engineers and developers share common things that they can build on. It really is a savings for NASA if there are some common elements in the source that everyone can use or use pieces of it."

She estimates that open source could reduce development time by 70 percent.

To further external participation, the Open Innovation Program started the annual International Space Apps Challenge in 2012. For a 48-hour period in April, people worldwide collaborate on open source solutions to problems related to the agency's mission using NASA's open data. In the first year, 25 cities participated. Last year, 8,000 participants in 95 cities created 700 projects.

So far, the agency has not rolled any of the resultant solutions back into NASA, but that is a goal, Beck said.

"If we can really make that work where we can share it internally, then it really does help us do business better," Beck said.

THE NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

The terms "intelligence" and "open" don't usually fit in the same sentence. But ever since The National Geospatial-Intelligence Agency (NGA) set itself up with a GitHub account and started sharing in April 2014, things have changed. The Defense Intelligence Agency (DIA), Army Corps of Engineers, and Britain's Science and Technology Directorate have reached out to find out what NGA is doing and how it did it.

"So if you see DIA pop up with something, we helped them with that," said Chris Rasmussen, Public Software Development Lead at NGA. "There was a lot of hard work that needs to happen over there, but if you see that happen, it's a pretty cool connection."

To be fair, Rasmussen said, the National Security Agency has roots in the open source community. It submitted its Accumulo secure database technology to the Apache Foundation in 2011.

"The difference between the NSA and the other work is we did it under an organizational account, and we do it under our brand so people can just discover all of our offerings in one place," he said. "The response has been pretty positive. You have some first-mover advantages because it was a first and it was an intelligence agency, and that word does come with some cachet and kind of excitement. When a company does it, it's cool, but an intelligence organization has that patina to it and doing that first, it did give us some advantages as far as exposure."

NGA's GitHub account has two main repositories: MapReduce Geo (MrGeo) and GeoQ. The agency released MrGeo in collaboration with DigitalGlobe, a provider of commercial high-resolution Earth observation and advanced geospatial solutions, in January 2015. It's "a geospatial toolkit designed to provide raster-based geospatial capabilities that can be performed at scale," according to NGA.

GeoQ, NGA's first GitHub offering, is an open source geographic tasking system developed by the agency and the MITRE Corporation to let users collect geographic structured observations across a large area, but manage the work in smaller geographic regions, NGA said.

The agency is working with Huntsville, Ala., and the Federal Emergency Management Agency on GeoQ applications.

"We're actually working on and contributing back to the GitHub account," said Raymond Bauer, Innovation Lead at NGA. "It's a great place to centralize our transparency and our sharing of the code. We've also had some folks just out of the blue who have contributed changes and said, 'Gee, if you change this and change that, it will be more effective.'... Right there we just got some folks that helped us out for nothing."

That wouldn't have happened in a closed network, Rasmussen added.

"The advantage to working in a big, big bucket with millions of eyeballs is the likelihood of contribution and connection is much higher than it is in a closed system," he said. "This is taxpayer-funded software – it needs to be given back when appropriate. Second, if we would have gotten one contribution that we didn't have to pay for in addition to the taxpayer piece, it would have been worth it. We've exceeded expectations by orders of magnitude."

Citizen interaction and inter-agency collaboration may be new for intelligence organizations, but open source is proving its worth.

"What we're getting out of this is innovation," Rasmussen said. "This is getting out of our comfort zone into a broad talent base and you have to think differently when you're in a platform that large. ... There's no more clear example of showing what we're trying to work on than showing source code."

> *DARPA's approach to open source is that if a project is publicly funded, involves fundamental research and has no security requirements for secrecy, it should be freely available and accessible.*

DARPA

THE DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

Defense is another area that at first blush doesn't seem ripe for open source, crowdsourcing or sharing. But at the Defense Advanced Research Agency (DARPA), open source has been used periodically for several years. More recently, though, the Defense Department's main innovation arm has embarked on a more cohesive approach.

"Over the years, some programs and program managers on a project-by-project basis had open source or liberal licensing rights, but it was very much at the discretion of the manager in order to meet the objectives of the program," said Christopher White, Program Manager at DARPA's Information Innovation Office. "In general, DARPA has been doing this for a long time. It just hasn't been as organized or as emphasized as it has been in the last year or so with the Open Catalog."

Open Catalog is the culmination of an effort to document and make easily available to the public ongoing work. It started in February 2014 with software toolkits and peer-reviewed publications from the Information Innovation Office's (I2O) XDATA program, which was one of the first projects that was by design open source for all teams and for all work.

Six months later, the catalog's software library had more than quadrupled from 75 to about 350 entries, and its publication library grew tenfold to 1,100 entries. Additionally, the catalog added 20 more I2O programs and research from DARPA's Biological Technologies Office and Defense Sciences Office. In its Open Government Plan for 2014, DOD named Open Catalog a flagship initiative.

"What that has left us with has been a very large stable of software that you see on XDATA Open Catalog page, with like 150 pieces of software from 30-plus different teams," White said. "What we did was use that as the foundation to organize the work for many of these other programs, and now the catalog has grown to 30-plus programs and thousands of papers and pieces of software."

The catalog's contents have different types of open source with different licensing and rights. For example, sometimes only source or binary code is available.

"Some of the software that's on the catalog that requires a request to download has constraints around the rights and licensing restrictions," White said. "So it's available but it's only available for certain circumstances," such as for official government purposes or work on government contracts. In that case, DARPA can still publicize the investment, what it led to and what the software does, but to get the source code, developers will have to contact the company that wrote it.

DARPA's approach to open source is that if a project is publicly funded, involves fundamental research and has no security requirements for secrecy, it should be freely available and accessible. "The catalog serves that purpose, really," White added. "It's more of a description of ongoing work and investment to make the outcomes of those investments that are publicly available."

Without open source, certain categories of development wouldn't be able to happen, White said. For example, software that has components built by different companies or university groups would typically have problems with integration or conflicts of interest. Also, including contributions from people outside funded research wouldn't be possible – at the detriment of adding value.

THE DEPARTMENT OF VETERANS AFFAIRS

As one of the largest federal agencies, the VA leads the country's biggest integrated health care system, with more than 1,700 sites of care and almost 9 million enrollees, according to an August 2014 report. Part of that system is the Veterans Health Information Systems and Technology Architecture (VistA), an open source electronic information service made up of more than 100 applications that powers the Veterans Health Administration (VHA) facilities.

Although VistA serves its purpose in linking VHA organizations, it fell short in building a community, CIO Stephen Warren said in an OpenSource.com article last March. To remedy that, the department's Office of Information and Technology established the Open Source Electronic Health Record Alliance (OSEHRA) in 2011 as a nonprofit to "build and support an open source community of users, developers, service providers, and researchers engaged in advancing electronic health record software and related health information technology," according to OSEHRA's website.

18F

"When we started, this was purely in the health arena with very much a focus on our VistA software," said David Peters, VA's Acting Deputy CIO for Product Development. "OSEHRA has basically built our community, maintains our website, our presence, runs numerous working groups associated with open source topics, where people from VA and the community interact together, solve problems."

Openness isn't new to VA, which has been providing software through Freedom of Information Act requests for years. But that was one-directional and time-consuming because VA had to search for the software, identify it, redact any sensitive information and send it out.

With OSEHRA, "we are continuing along that same process," Peters said. "We still continue to send all our software to OSEHRA in a redacted form, but it's far easier than going through a FOIA request to retrieve that information. So, I guess you could say it was really kind of the stepping stone to really going full blast to open source with OSEHRA.org."

An important benefit of open source to him is expanding the software developer base. "If you think about it, the sort of maintenance and bug fixes and advice you get from the open source community is really kind of a force multiplier at VA."

Major contributions from the open source community are FileMan 22 and 23, which contain thousands of defect fixes and enhancements that VA will use as part of its core VistA in the next year, Peters said. FileMan is part of VistA's underlying code that manages files.

18F

Named after its location inside GSA at 18th and F streets in Washington, D.C., this agency is getting ready to celebrate its first birthday this spring. Staffed with former and current Presidential Innovation Fellows, 18F's mission is to build "effective, user-centric digital services focused on the interaction between government and the people and businesses it serves." Translation: Use technology to make mission-critical but interesting stuff.

Because 18F is in the business of bettering agencies, chances are good that something it creates for one could also be useful to another. That idea plays into the agency's open source policy, which states that in developing new products, the team will use Free and Open Source Software, which does not charge users a purchasing or licensing fee for modifying or redistributing the source code; develop work in the open; and publish publicly all source code created or modified by 18F, whether developed in-house or through contracts.

None of what 18F has done so far would have been possible without open source, said Eric Mill, an 18F team member.

"It's the foundation of all software development today," Mill said. "Every project that we do – and we're just the ones that are willing to say it the most loudly – every project we do depends on millions of lines of open source code run by other people at some level. And that's the way the world operates today."

CFPB

CONSUMER FINANCIAL PROTECTION BUREAU

A project to watch is 18F's pairing with the Federal Election Commission (FEC) to research ways to better share information on political candidates and committees, Mill said. It's entirely open, from the code to the designs to FEC's data, which is refreshing for an agency that gets a lot of negative attention because of its politically polarizing work, he added.

"When I came on and heard that we were working with them and that all the commissioners are working with us and that we're going to be working on the open, and that that wasn't a problem, that was a real head-snapping thing for me, and really made us, made me feel like we're actually changing how the government does work," Mill said.

And role model is one of 18F's jobs – or perhaps a happy byproduct of its work. Its success can be measured by the team's nine pages of blog posts on topics such as "How to Use More Open Source in Your Next Federal IT Acquisition" and "The Contributor's Guide to 18F: Code for the Common Good" and by its employee roster count, which went from 15 to 57 since last March.

"I think the clearest thing is to be a leader by example, and in some ways make it look so normal and natural that it is just not something that even really seems radical anymore," Mill said of open source. "We're honestly not the first people to do that in the government. The Department of Defense and the White House and the Consumer Financial Protection Bureau defi- nitely paved the way for us to be able to do what we're doing. But it's also fair to say, I think, that we've gone further than anybody else in making it a really strong default and the way of working for our projects."

When asked about federal agencies getting open source right, experts almost always point to CFPB. Established in 2010, its stated mission is "to make markets for consumer financial products and services work for Americans — whether they are applying for a mortgage, choosing among credit cards, or using any number of other consumer financial products." But, like 18F, it's also serving as a model for openness.

"The bureau has a very upfront open source policy," said Michael Byrne, Home Mortgage Disclosure Act Technical Operations Lead at the bureau, which shares its design platforms and Cascading Style Sheets on GitHub. "We develop all internal custom applications as open source code by default, and that gives us all kinds of flexibility. We really find this to be the best approach in terms of software delivery in terms of both quality and time. It has offered the agency a tremendous value return."

Byrne watched CFPB develop while he worked at the Federal Communica- tions Commission and found the approach inspiring. He especially admired the bureau's work on eRegulations, a web-based application that puts complex regulatory language into plain English.

Other projects of note include:

· Qu – a public data platform that is all open code and gives the bureau streaming APIs for delivering large datasets such as Home Mortgage Disclosure Act data.

· Owning a Home – a new suite of tools that guide people through the home buying process.

· Idea-Box – an application that lets an organization collect ideas and comment and vote on them.

These projects would have been possible using large government procure- ments or off-the-shelf software, but they wouldn't have been as robust, Byrne said.

"It would have resulted in systems that were bloated or didn't work or had long times to market," he said. "What we end up with today is a wonderful, speedy way of producing production software and providing technical solutions. And we get to innovate off of those things. That's super exciting."

3 State and Local Use Cases

Though open source technology is generally more often used at the federal level, state and local governments are certainly getting in on the game, too. Here are three case studies of local govies that are embracing open source technology.

OPEN311

BLOOMINGTON'S GEOREPORTER AND UREPORT

Bloomington, a city of about 83,000 people in southern Indiana, proves you don't have to be big to do big things with technology. It's been using open source since 2008, when it built its website on PHP scripting language and the MySQL open source database, running on Apache web server and Linux. Its content management system uses free software under the GNU GPL license, and the site incorporates other open source components, including a search engine.

"We've had a positive approach and interest in open source for some time and that goes back more than a decade," said Rick Dietz, the city's Director of Information and Technology Services. All internally-developed applications and websites are based on open source tools, and when the team has built its own, it has released them as open source, too.

"We're able to put together existing open source tools in ways you can't necessarily do with commercial products," Dietz said. "We're able to do that at a lower cost."

A recent project for the city is a suite of integrated applications for Open311, which gives the public a way to report non-emergency problems and the city a way to manage those reports when they come in. The suite, announced in 2012, has three components: uReport, GeoReporter and a JavaScript-based page that provides a client interface like that of smart phone applications but it can be embedded into a website.

UReport is the underlying Open311 service. It provides an Open311 application programming interface (API) and serves as a Constituent Relationship Management (CRM) system that routes reports to the appropriate city worker.

The third component of the system is smart phone apps. One called Bloomington works only in this city, but one called GeoReporter would work for any city in the Open311 system. An end user downloads the

app to an iOS or Android device and selects from a list of cities that have opened their Open311 endpoints.

Next, it loads in all the reporting options that the city has made available through its Open311 endpoint API. Users can choose from 40 reports in the Bloomington system. The most popular, Dietz said, are graffiti and potholes reporting. Users can take a picture of the problem with their smart phone, pinpoint the location on a map, provide a description and answer any questions in the report. The final step is submitting the report, which then passes through the Open311 API and into the uReport CRM system.

"As part of the process of rolling this out, we converged, I think, at least four different call-logging and case management approaches that different departments were using into one," Dietz said. "That's allowed us to have one tool that's accessible to city staff throughout the entire organization, and that allows us to be more efficient and effective case managers."

It's also opened new pathways to citizen engagement. "These types of systems don't necessarily displace citizens that are already calling in or e-mailing staff, but they are a newer group of people who previously haven't interacted with the city as much," he said. "When you have a tool that lowers the barriers for reporting those issues to the city that makes it more of a casual activity, then you bring in a different group of folks who may not be out there day-to-day reporting issues to the city like some people do."

The Open311 suite started as a partnership among Bloomington, San Francisco, Portland, Ore., and others. Ultimately the city opted to move forward alone, but Dietz said open source is an ideal way to foster cross-government sharing and communication.

"There's thousands of municipal governments and we are all doing essentially the same thing and have essentially the same software needs," he said.

PHILLY

PHILADELPHIA

The City of Brotherly Love is living up to its name with its latest open source push. To redesign its website, Phila.gov, it's welcoming contributions from the public. A prototype of the new, open source-based site, has been running alongside the existing site while it's in alpha testing since Dec. 23, 2014. It uses a WordPress-style theme released on GitHub (the old one used SharePoint), and the Office of Innovation and Technology (OIT) team refreshes it every two weeks.

"The reason for the prototype is really to give citizens an opportunity to provide us feedback, and over a period of seven or eight prototypes we get really close to what citizens want to see as far as their website," said Adel Ebeid, the city's Chief Innovation Officer. "People seem to think it's a very fresh, new approach to designing what ultimately will be the website for the people."

Common suggestions are about where things such as navigation fields are placed and not having to click more than three times to find information. Ebeid estimates a total of seven or eight prototypes and an official launch in late spring or early summer.

"We wanted to walk the talk, so we're putting the most mission-critical, heavily visited service, we're taking it out from the data center to the cloud, and we're basing it on what people want to see when people visit Phila. gov," he said.

Philadelphia is the biggest government user of GitHub, with 55 repositories, he said.

"As a CIO, my two biggest things that I look at are the cost to implement and the time to implement," Ebeid said. "Open source really cuts across both of those. I'm not in the business to build IT; I'm in the business to manage IT so I'm not looking to build an infrastructure or purchase large amounts of licenses. The right to own licenses is not that big of a factor for most CIOs these days."

The city's other open source projects include:

- Property Search – The highest trafficked application on Phila.gov, lets users look up properties throughout the city to find out characteristics, ownership information and assessment records.

- L&I Property History Widget – Part of the Philly 311 Mobile App, this helps users look up properties and see the history of permits, licenses, violations and appeals from the Department of Licenses and Inspections.

- Election Day Widget – Also part of the Philly 311 Mobile App, it helps voters figure out where to vote, gives a sneak peak of ballots and provides other election information.

- Phila.gov/map – This lets city departments publish their data to the public in a user-friendly, easy-to-digest map interface.

- Crime Map – On the Police Department website, users can see recent crimes in their area.

"In our minds, there's no decision to make. It's an open source first strategy," Ebeid added. "It's part of our toolbox now. It's not really whether we do it or not. It's part of our default thinking."

GEORGIA TECHNOLOGY AUTHORITY

In 2011, the Georgia Technology Authority found that the enterprise CMS it had been using for Georgia.gov was no longer cutting it. An attempt to upgrade to a more recent version failed, and the system overall was installed on old servers, making outages increasingly frequent.

"The analogy I used to use internally to explain what we were doing is that in 2003 we bought a steak knife that worked really well and cut steak really well, and by 2012 it had turned into a Swiss Army Knife with tweezers and cork screws and magnifying glasses and a bunch a stuff that we just didn't need that was really getting in the way for us," said Steve Nichols, Georgia's Chief Technology Officer.

His team began researching options. Open source solutions – specifically, Drupal – quickly floated to the top of the list.

"Looking at the overall landscape of open source implementation at the federal level, the Drupal solution seemed like it was a pretty solid, stable solution just for the fact that it was implemented by some really high-profile federal agencies," said Nikhil Deshpande, Director of the Georgia.gov Interactive group. "When we saw the implementation for the House of Representatives, it really was like the similar implementation for what we were looking for. So that's when we just zeroed down on Drupal and just specifically asked for bids for that."

Ultimately, GTA contracted with three vendors: Phase2, which set up the platform using a government-focused distribution of Drupal called Open-Public; Acquia, a Drupal hosting company; and Mediacurrent, which helped with the migration of content, according to a case study on the move. Everything is hosted on the cloud using Amazon Web Services. Within 10 months, the team moved the state's web portal and 55 agency websites to open source, making it the first state government to do a full enterprise Drupal implementation.

The sites were moved in batches of four to five, and each phase, or sprint, took about two weeks. There was no downtime during the migration.

"It was literally like moving 55 families from one house to the other," Deshpande said. "Each of them had their own expectations, each of them had their own list of requirements."

In this new setup, the sites are easier to update. Georgia.gov went live in 2002 and had one update, in 2006, before GTA moved it from its data center to the cloud and open source, according to a migration document. To make changes before, employees from CMS provider Vignette or its partners would have to assist. Now, because Acquia is hosting Drupal for many customers, security and other updates are automatic.

"For them, upgrading Drupal is just part of what they do every day falling out of bed," Nichols said. "They're just so on top of the security. There's been lots of zero-day vulnerabilities that come out for Drupal, and we're hearing about it in the rearview mirror from our supplier because they've already patched all the systems."

At the outset, GTA predicted the move would save about $4.6 million over five years, a number that's tracked well.

The savings come from three main reductions, Nichols said:

- Licensing fees. Vignette cost $1.3 million per year, while Drupal is open and "basically zero."

- Staff. Two Java developers were able to move on to other projects, one still within GTA.

- Data center costs. The per server cost dropped when GTA moved to Amazon.

GTA also eliminated more than 30 servers. Hosting costs are higher than GTA initially budgeted for, however, because more agencies are asking to join the setup and others are asking for new features that didn't come in the base set, Nichols said.

"We've significantly grown our footprint," he said. "We've had to go back to our supplier... and ask them to add and customize some other Drupal modules for our customers. So we've ended up spending more, but you know, not for lack of planning.... We've been pleasantly surprised by the increase in demand."

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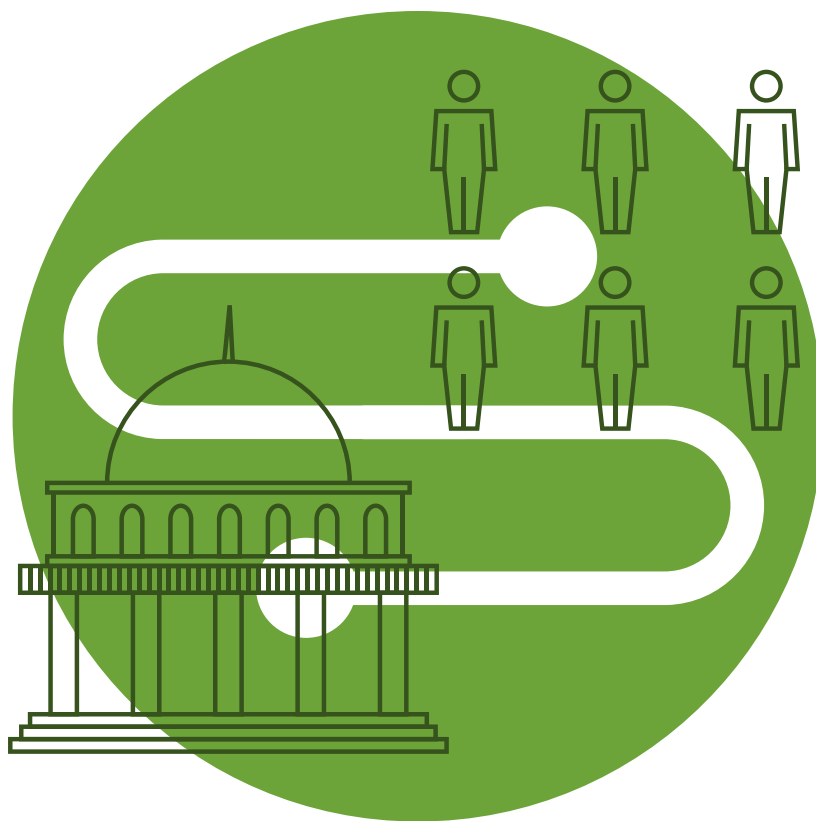
The Department of Veterans Affairs runs a data hub built on MongoDB, which stores and serves up patient data and other sensitive information.

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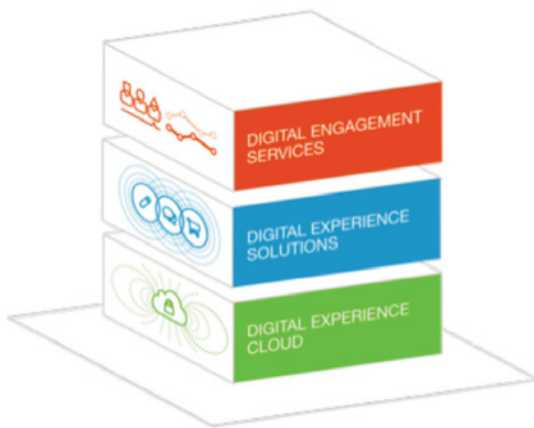
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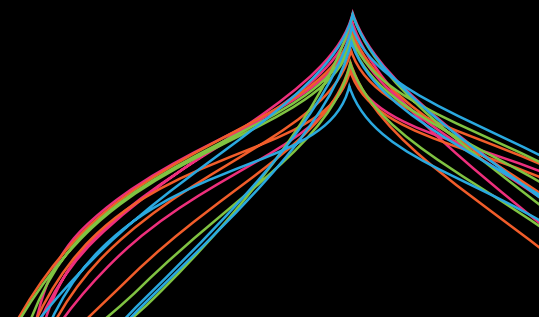
Finding Technology to Achieve Digital Goals

An interview with Todd Akers, Vice President at Acquia

As agencies strive to meet their digital initiatives, they must identify the right technologies and industry partners to help them meet their goals.

Yet not all partners collaborate equally, and not all technologies provide the necessary agility to keep pace with digital innovation. To learn how agencies can think ahead to best align their needs to technologies and partners, we spoke with Todd Akers of Acquia, a open source digital platform solutions and services provider.

Akers explained the intrinsic value of adopting open source technologies. "Agencies need digital platforms that allow them to focus on information and service delivery, personalization, and integration of mobile applications and social platforms. Open source platforms help agencies achieve these goals by enabling agencies to replace outdated, costly proprietary platforms with technology that is agile, scalable, and allows for greater citizen engagement and more efficient operations. Additionally, they are far less expensive to procure, implement, and maintain and allow agencies to improve their cost structure and reallocate resources to other mission-critical projects."

DETERMINE YOUR MISSION

Nevertheless, the cost of a platform should not be the primary driver in decision-making. Before any determinations are made regarding technology, Akers said that agencies must first diligently research the needs of their citizens and how they are consuming information and services from an agency. Agencies also need to consider their internal users and how a technology will enable them to most effectively reach citizens.

"We're all in this interconnected world where there's multiple channels that we can engage corporations or government agencies on," he said. "We expect to be able to access government services easier, via any digital device. So, that expectation is certainly going to drive decisions for the governments that are responsible for delivering those services to the citizens."

However, agencies must consider more than market expectations as they determine their citizens' needs. "Obviously you have to engage the end user and do the testing to determine the effectiveness of the application that's being developed," said Akers. "But you have to have some introspection on this, too, and consider the mission of your agency and what you're responsible for providing to the citizens of your city, county, state or the country." In other words, you have to prioritize those services and determine what can best be made digital.

MATCH NEEDS TO TECHNOLOGY

The needs of your citizen and internal users will not only dictate what services should be digitized; they will also largely influence which technologies are chosen to execute the project.

For example, when Los Angeles needed to update its outdated proprietary web platform, it was determined that disaster response was a critical area of improvement for the citizens it serves and a robust digital platform was key. They needed an open source platform with cloud-based technology and hosting that would support the agility, scalability, and reliability necessary to provide those services. So, they selected Drupal and Acquia Cloud Site Factory to meet those needs.

"What happens a lot in the city of L.A?" asked Akers. "Earthquakes. They needed a combination of an innovative open source platform to integrate modules and APIs to deliver potentially life saving information and services to citizens and a resilient cloud platform that would stay up and enable their site to remain operational during a disaster.

LEVERAGE TECHNOLOGY FOR FUTURE NEEDS

The agility of open source technologies allows agencies to meet new challenges as they arise. Sites can be scaled at need, existing modules can be used, new modules can be contributed for other agencies to use, and as the technology advances, the agency will not have to go through the procurement process to update functionality or pay for costly contractors to write new code.

"The fastest and most cost effective way for agencies to keep up with the speed of innovation occurring across the digital spectrum is with an open source platform," said Akers. "When you identify a need, you can tap into developer resources in the open source community who may already have created a solution."

By partnering with a provider like Acquia, agencies can ensure they get the most out of these resources. "Acquia is the only enterprise-class platform with application level support solely focused on Drupal," said Akers. "That level of focus means that no one can match the efficiency, agility, or connected abilities of the Acquia platform."

If agencies match the appropriate technologies and industry services to their digital roadmap, they can meet the needs of citizens today and the challenges of tomorrow. "If you envision it, you can build it and deploy it with Drupal and the Acquia platform. Our technology allows you the keep up with the pace of innovation, and focus resources on the business of serving citizens," said Akers.

What's Ahead for Open Source in Government

O ne thing is clear: Open source is making its presence known in the public sector. Experts expect use of it to grow in 2015.

"We're coming to a point where agencies that aren't in the open source community are almost feeling behind the curve," GitHub's Balter said. "I think we'll be seeing a lot more conservative agencies begin to participate in the open source community."

Additionally, edicts from the top will also further open source. The Obama administration has made open government a cornerstone of its remaining time in office, using past mistakes to push a refreshed agenda, said Balter.

"For many in government, HealthCare.gov was the great 'I told you so' moment or possibly the first 'I told you so' moment where throwing more money and more people at a problem is not necessarily the best way to solve the problem," Balter said. "But thinking smarter and working more openly can often produce better results."

CFPB's Byrne and other experts hope that citizen engagement will increase in the coming months. He would especially like to see the bureau receive more pull requests, which let contributors alert others to changes to a repository. Byrne expects little changes to go a long way.

"When Twitter came out it was pretty interesting because it wasn't a blog," he said. "It was someone being able to share 140 characters. You reduce something to be super small as a metaphor. I think in our case in the code environment, I think what you're going to see is lots of tiny functions. Some might call these microservices and these microservices might be open to returning very, very tiny bits that will be super cool because anyone can use them as opposed to much larger, harder-to-implement kinds of solutions."

Ultimately, it makes sense that U.S. governments and open source technology become better acquainted. They share a foundation in that both were created to be collaborative and engaging, encouraging citizens to play a role in bettering their lives.

"I've always said that government is the largest and longest-running open source project, and we need to treat it like an open source project," Balter said.

Your Open Source Cheat Sheet

Open source is defined as "something that can be modified because its design is publicly accessible," according to OpenSource.com. "Open source software is software whose source code is available for modification or enhancement by anyone."

This type of software gives users more control because they can study the code for problems and easily make changes. Open source must not be confused with open data, which is "data that can be freely used, reused and redistributed by anyone," according to the Open Data Handbook. In other words, open data is the output of a closed or open source system.

The biggest advantage of open source to governments is that it enables agencies to find one solution to common challenges and to replicate that solution as often as needed – without a hefty price tag.

Second, open source saves governments money. It's simple: If the information is there for the taking, there's no need to spend taxpayer dollars on reinventing the wheel.

To encourage and facilitate the use of open source, the White House and other agencies have issued directives, including:

- The Digital Government Strategy
- The Open Government Initiative
- The Open Government Directive
- Open source software policy
- The U.S. Digital Services Playbook

FEDERAL AGENCIES WITH OPEN SOURCE POLICIES INCLUDE:

- 18F
- CFPB
- The Defense Department
- GSA
- NASA
- VA
- The White House

Looking ahead, open source will continue to prosper in the public sector. As agencies without open source efforts start to feel behind the curve, they will work to make executives and employees more comfortable with them.

For a more comprehensive list of government open source projects, visit Govcode.

"Open source software is software whose source code is available for modification or enhancement by anyone."

- OpenSource.com

ELEVATOR PITCH

Looking to start using open source technology at your agency, but unsure how to garner support for it? Try this elevator pitch from Balter:

"Open source is not only the right thing to do, it's taxpayer-funded code. You can generally deliver higher-quality software faster than you can with the proprietary counterparts. It's the same story as Wikipedia vs. Encyclopedia Britannica where you work in the open and engage people directly, and when you actually have a dialogue, you end up with a better result."

Acknowledgments

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