

GOVERNMENT TECHNOLOGY

SOLUTIONS FOR STATE AND LOCAL GOVERNMENT

VOL27 ISSUE1 | JAN/FEB 2014

TECHNOLOGY
THAT'S SET
TO TAKE THE
WORLD BY
STORM.

THE
NEXT
BIG
THING



WEARABLE TECHNOLOGY / 3-D PRINTING
CROSSBAR MEMORY / LASER NETWORKS
ELECTRONIC SKIN / CO-PROCESSORS



GETTING AHEAD WITH GRANTS

The federal government alone offers billions of dollars each year in IT grants that are often targeted to local governments.

But how can government agencies take advantage of these grants to fund technology initiatives?

To answer this question, *Government Technology*, in partnership with CDW•G, created a comprehensive grants guide and held a complementary webinar. Download both for:

- ▶ A list of technology grants by vertical
- ▶ Tips on how to maximize your chances of being awarded grants
- ▶ Best practices to managing grant funding for successful outcomes

Download the webinar archive at www.govtech.com/webinars/Winning-Programs-A-Guide-to-Grants-for-Government.html

For a free download of the grants guide, visit www.govtech.com/grantsguide



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COVER IMAGE: SHUTTERSTOCK.COM

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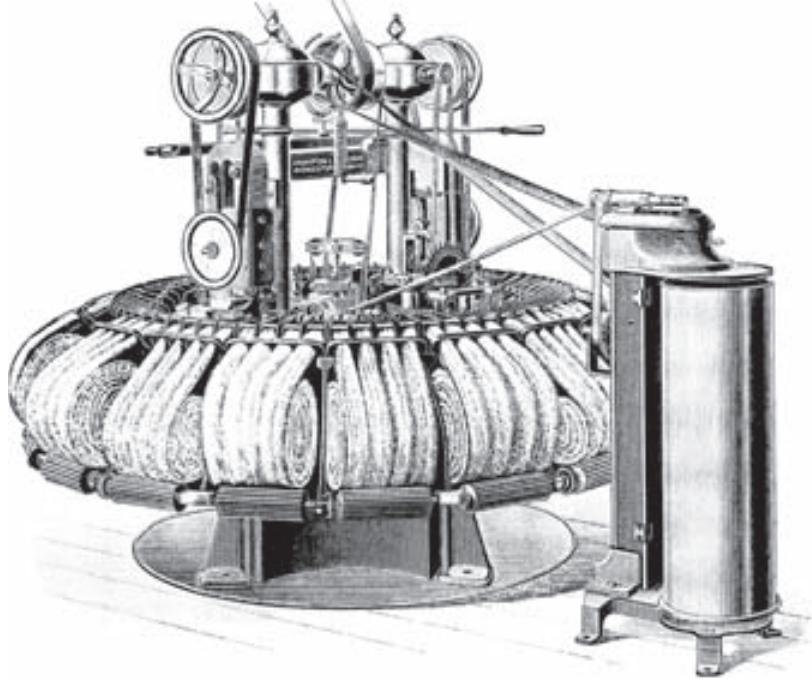
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Changes for the New Year

Welcome to our first issue of 2014. You may have noticed that this is a January/February double issue — part of a change we’re making to our print publishing schedule this year. We’ll have another combined issue for July/August.

Publishing slightly fewer print issues this year lets us better align our resources with the way you consume information. We know that more and more of you are digital natives, and so are we. The 24/7 schedule of *Government Technology*’s online platform — govtech.com — often is better suited to covering the dynamics and pace of change in technology and government innovation.

If you haven’t visited govtech.com lately, stop by and check it out. We’re investing in expanded online coverage of important topics like open data, civic technology and IT-related legislation. And we recently unveiled a vibrant new site design.

In addition, we’ve bulked up our daily electronic newsletter — Govtech Today — with more articles and features, and redesigned it for easier readability on traditional desktops and mobile devices. It’s free, and it’s a great way to stay on top of job-critical developments.

So what does the future hold for the print version of *Government Technology*? Don’t worry — we’re committed to upholding the magazine’s tradition of credible, high-quality coverage of technology for state and local government. Our peers at

the Western Publishing Association named *Government Technology* the best print magazine in its category last year, marking the 10th time we’ve received that honor since 1999. You’ll continue to find the articles you love and the insight you need right here on the pages of *Government Technology*. You’ll also see some new features in the coming months, like expanded “how-to” information on important topics.

Of course, we’ll continue to bring you solutions and case studies, along with analysis of industry trends. This issue is a great example.

On page 26, we look at one of the industry’s hottest trends: wearable technology. Google Glass may not be widely available yet, but that hasn’t stopped people from theorizing how the device might be used in the public sector. Plenty of other wearables — that strap onto your wrist, perch on your nose or simply become part of your clothing — are poised to reach the market as well. And on page 14, we explain how breakthroughs like graphene and crossbar memory could transform the technology you use.

Happy New Year — it’s going to be an exciting one. **GT**

RAISE YOUR VOICE

Your opinions matter to us. Send comments about this issue to the editors at editorial@govtech.com. Publication is solely at the discretion of the editors. *Government Technology* reserves the right to edit submissions for length.



AN AWARD-WINNING PUBLICATION



Silver Photo: Editorial Excellence Award

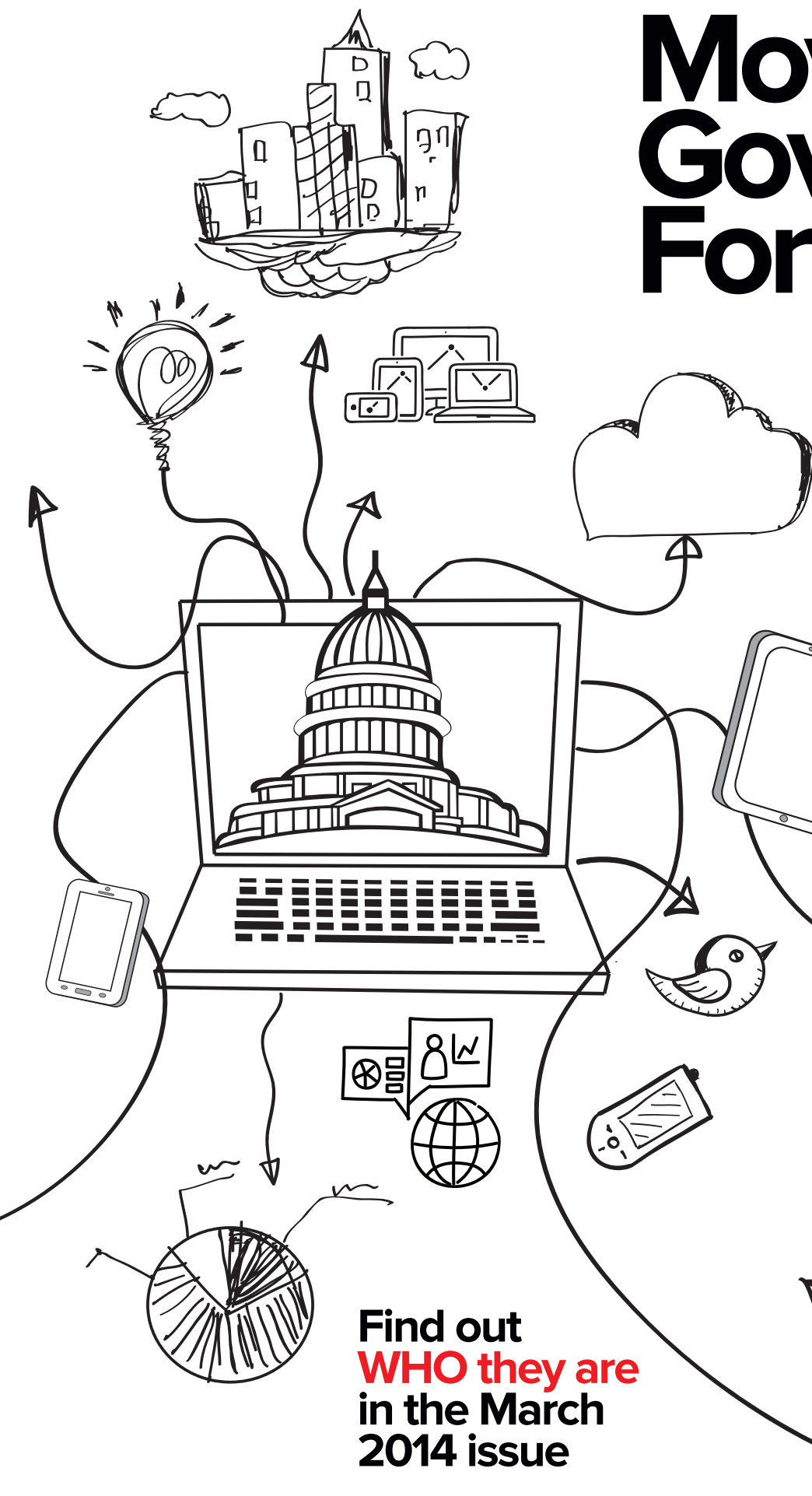


Moving Government Forward.

Doers:
Making Government Work

Dreamers:
Changing Convention

Drivers:
Improving Citizens' Lives



Find out
WHO they are
in the March
2014 issue



Evacuation Tracker

Just more than one year after Hurricane Sandy's waters flooded the northeast, cutting power and forcing more than 7,000 patients and residents at hospitals and nursing homes to evacuate, New York demonstrated that it can now track those vulnerable citizens during the next big storm. A demo in November at a Manhattan hospital used the state's **Evacuation of Facilities in Disasters System**, which the New York State Office of Information Technology Services devised over the summer. Using pre-printed wristbands with bar codes and identifying numbers, handheld scanners, a mobile app and optional paper tracking, the system tracks patients and residents in real time across facilities.



\$13
MILLION

The amount of a contract in Maryland to install "positive train control" equipment, which uses GPS and radio signaling to react automatically if a collision or derailment is anticipated.

Healthy Terms

New federal legislation establishes a national definition of telehealth and clarifies which electronic methods can be used to safely deliver health-care services. The Telehealth Modernization Act of 2013 provides principles to guide states that are considering their own telehealth policies. Introduced in December, the legislation aims to standardize what telehealth is and promote its use.

Rep. Bill Johnson, R-Ohio, explained that the bill — **H.R. 3750** — isn't a mandate directed at states. Instead, it encourages them to look further into telehealth as a viable option for physicians and patients to maximize the quality of health care.

“To be in [Criminal Justice Information Services] compliance, the biggest challenge here will be background checks on each and every Microsoft employee with physical or logical access to these facilities. This is difficult where multiple data centers are involved. As well, the government agencies using these cloud-based services will need to verify (by audit) that Microsoft has these technical and personnel controls in place. Many folks do not realize that using the cloud is not the ‘easy button,’ rather, it makes verification of compliance more difficult. You cannot secure that which you cannot control.

JohnBison in response to **Microsoft Ups Ante in Cloud Security**

“I think user friction is one of the major barriers to better security right now. If you're having to worry about keeping up with another piece of hardware, whether it's a key fob/token or a wearable like a ring, that can be cumbersome and frustrating. However, something you have is better than something you are — you lose your phone or it gets stolen, though unfortunate, you can replace it. If someone gets ahold of your fingerprint, that's going to be pretty painful to change, literally.

ToopherLex in response to **Why Do We Still Use Passwords?**

“I spent 23 years in law enforcement with most of them spent investigating robberies and other major crimes. My experience extended to working in a Real Time Crime Center in NYC. Technology such as predictive analytic tools are indeed a tool in the toolbox, but it requires human intervention — if not done it negates the reason for the technology. In theory, predictive technology makes for more efficient policing due to targeted enforcement. But do we know if we are displacing criminals to another neighborhood?

Gary A Maio in response to **Predictive Policing: An Effective Tool, But Not a Crystal Ball**

WHO SAYS?

“I have yet to meet a jurisdiction that offered any special support to independent app developers.”

www.govtech.com/quote-Jan14

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Enterprise Mobility: Transforming Public Service and Citizen Engagement

Research reveals the cost benefits and service enhancements enabled by mobile solutions.



Enterprise Mobility: Transforming Public Service and Citizen Engagement

Research reveals the cost benefits and service enhancements enabled by mobile solutions.

The Essential Ingredient for More Efficient Government

With global mobile penetration at approximately 74 percent and over half of the world's population owning a cell phone¹ (over 90 percent in the United States²), the message for state and local governments is loud and clear: Enterprise mobility is an essential ingredient to bridge the connection between governments and their constituents.

From Canada and the United Kingdom to India and Australia, citizens are embracing mobile technology — and government agencies must do the same. In certain cases — where citizens may not have a TV or computer — the only way for governments to communicate with citizens is via a mobile device. The potential for this

communication is almost limitless. With the right mobile solutions and strategies, agencies and municipalities can increase the efficiencies of internal operations, improve services and reduce costs.

The question is, where does the public sector stand on meeting these expectations? Do expected benefits justify required investments in mobile solutions in times of tight budgets?

Survey responses discussed in this paper offer important considerations to help governments effectively leverage mobile solutions. These include:

- Improving the lives of constituents by delivering better services, enabling safer communities, and enhancing educational and public health outcomes

Executive Summary

In late 2013, the Center for Digital Government (CDG) launched a comprehensive research study to document the state of enterprise mobility in government in the U.S. and throughout the world.³

Specifically, the survey sought to identify the top drivers pushing agencies and municipalities to increase their commitment to mobile solutions. Respondents were also asked to provide details about the impact enterprise mobility is having in key departments, including public safety, health care, social services and transportation. Additionally, the survey looked at stakeholder perceptions of how mobile technologies affect citizen engagement and government-to-citizen communication, and vice versa.

This white paper presents these findings and discusses the top benefits of mobile technologies to government agencies as identified by survey respondents. It also discusses the top four areas in which mobile technologies have the promise of delivering the greatest impact and provides specific examples of municipalities that are achieving success in these areas.

Throughout the paper are graphics with data pulled from the survey, which are meant to provide readers with an awareness of their peers' opinions when it comes to mobile solutions and the ways in which they see them as most beneficial to their organizations.

- Achieving greater operational efficiency through technology that delivers a clear return on investment for taxpayers
- Planning a successful mobile roadmap for the future

An overwhelming majority of global respondents to the CDG survey agreed on two overarching conclusions: Improving services and public education while reducing costs are the greatest measurable benefits expected. Secondly, mobile solutions can positively change the relationship between governments and their citizens.

The Value of Mobile Solutions

Reducing costs and improving efficiencies. It's no surprise that in today's era of tight budgets, the financial impact of any new technology, including mobile solutions, receives close scrutiny.

The good news, however, is that an impressive 85 percent of global respondents agreed that mobile solutions can directly reduce expenses in agency operations. The ways mobile solutions impact public sector expenses are as varied as the missions of each agency and the constituents it serves, but a handful of practical use cases highlight cost-saving opportunities.

In Olmsted County, Minn., mobile technology enables a quarter of the Community Services Department's staff to telecommute and to be free from their desks, regularly working from the field. This is significant because the county has experienced a sharp spike in need for food support and health care services since the recent recession.

"It became difficult to keep up with demand, so one solution was allowing some staff members to telecommute in return for taking on additional caseloads," says Paul Fleissner, director of Olmsted County Community Services.⁴ "Our caseloads grew, in some cases 15 to 20 percent or more, depending on the program. I was able to show that we avoided additional costs because

I was not growing my staff commensurately. It also helped us retain people, and we've actually attracted people from other counties because we have such a strong telecommuting policy."

In a parallel move that boosted efficiency, Olmsted County created a mobile app that citizens use to navigate social services resources. After completing a survey that identifies their needs, citizens see a list of suggested services via the app. They can click on items for short descriptions and links to the associated website. Not only do constituents locate information more quickly, the social services staff is fielding fewer questions about services from citizens. "The people who may be the most excited about the app at this point are on my staff," Fleissner says.

Another cost saver for agencies is a reduction in paper-based processes thanks to the electronic data capture and delivery capabilities of mobile applications. Some municipalities are moving to paperless ticketing for rail service, which enables travelers to purchase and download an electronic ticket using their smartphones or tablets. For example, in London the government recently decided to invest 2.5 million pounds in a trial of smart ticketing to rail passengers. Smart ticketing will trigger automatic ticket gates for riders and make it easier for them to purchase tickets online and collect them at stations.⁵

Boosting workforce satisfaction and productivity. Over 90 percent of all respondents agreed that the flexibility afforded by mobile solutions can increase workforce satisfaction. Mobile technologies enable employees to work where they are most effective — whether that be from home or in the field for road warriors, case workers or public safety individuals. During weather emergencies or other situations where it is difficult for employees to make it into the office, mobile

Global Government Leaders Overwhelmingly Agree: Mobility Brings Big Benefits



Source: CDG/Governing Institute Enterprise Mobility Survey, 2013

technologies can ensure the wheels of government keep turning. Employees remain notified of what is happening in the workplace, can still provide needed approvals and communicate mission-critical decisions. Transactions and activities keep moving.

Agencies throughout the world are also using mobile solutions to streamline their internal operations. For example, over 90 percent of global respondents said mobile technology can increase the productivity of their workforces. Ready access to information is one of the reasons for this. For example, when municipal workers receive alerts regarding newly reported potholes or broken water mains while in the field, the information they need is automatically included. Workers can view relevant documents, including GIS maps identifying gas mains, power lines and telecommunications fiber, accelerating repairs. Not only does this reduce costs associated with repairs and damage to personal property, it reduces traffic congestion and health issues.

Increasing public and employee safety. Enterprise mobility creates a safer work environment for employees by providing critical real-time information. For example, agents with the Social Services Department of Hanover County, Va., use mobile devices to access central state records for child and protective services, law enforcement agencies and other departments. The information is essential when a staff member is called out in the middle of the night to check on the welfare of a child. “For us, mobile technology has helped enormously when it comes to safety,” says Sheila Crossen-Powell, director of the Social Services Department.⁶

“We can look up a family and discover if it is known to us or other agencies. If we identify that there are guns in the house or perhaps a family member with a drug record, we would definitely ask the police to accompany us,” Crossen-Powell says. She adds that the information downloaded from the state systems is secured with a virtual private network (VPN).

In the past, the information would only be available if the case worker first stopped at a department office, which delayed response times. “Our staff loves this resource — they feel safer, they have more information so they’re better prepared when they respond to a call, and together that improves morale for our people,” she says.

Mobile technologies also arm public safety officials with the data they need to make informed decisions on the fly. When asked to choose the safety benefits enhanced by mobile technology, the first choice for global respondents was the ability of response teams to access the right real-time information, make decisions quickly and respond appropriately.

Short-Term Revenue Boosts and Long-Term Gains

Mobile technologies can reduce costs in many ways, but the biggest or most immediate savings result from doing more with less and improving workforce productivity. For the cash-strapped government agency, seeing immediate results can be extremely gratifying. Jefferson City, Mo., provides a good example. The state’s Department of Transportation decided to shut down two major interstates for an entire year, rather than keep a lane or two of those interstates open and drag out the timeline for rebuilding. Additionally, it would have put workers’ lives at risk. Instead, the state provided mobile apps and maps to residents to help them maneuver around the highways and find alternate routes. The cost savings from using mobile apps to reroute drivers for a shorter period of time, rather than keeping lanes partially open, was \$100 million.⁷

Wins like these are encouraging some public sector leaders to take a long-term view of mobile solution opportunities as hardware and software technology evolves and mobile usage increases. For example, a large majority of survey respondents expect mobility-fueled improvements in government transactions with citizens, such as tax payments and license purchases.

Tourism and access to detailed visitor information will also benefit from mobile innovations, according to 69 percent of global respondents. For example, the city of Ottawa, Canada, encourages tourism through a smartphone app that gives tourists an easy way to find information about attractions and events. Users can also get airline and public transportation information, as well as scan QR codes around the city. Tourists can create social media-integrated custom postcards as well for additional fun.⁸ These uses of mobile technologies directly impact the economy and increase overall revenue.

In addition, an impressive 79.5 percent of respondents see mobile solutions helping improve road and traffic

conditions, while 72.5 percent of respondents envision better public safety and emergency response performance. Similarly, 57 percent of respondents see mobile technologies enhancing citizen engagement with law enforcement.

4 Areas Where Mobile Has the Biggest Impact

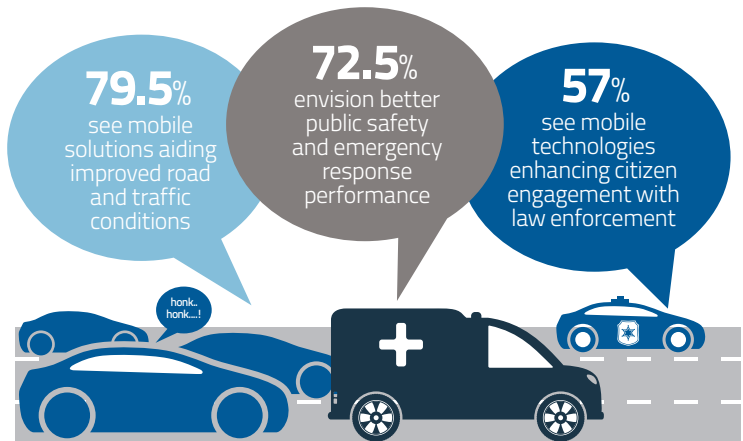
While expectations are high for future mobile innovations, there are four core areas of government that are being positively impacted by enterprise mobility now.

1. Community awareness and citizen engagement

A majority of survey respondents report that mobile solutions can fundamentally alter relationships between citizens and government. In fact, an impressive 95 percent of global public sector stakeholders see positive changes in these relationships thanks to mobile solutions. This happens through better communications that improve public awareness, something over 40 percent of global survey participants strongly agreed is a benefit of enterprise mobility.

Two-way real-time communication with context — including images, pictures, video, documents and more — help create an entirely different experience for constituents connecting with their government. This community awareness and citizen engagement with mobile technologies is a global phenomenon. For example, in Niger, Africa — a country that only recently returned to democratic rule — citizens are able to communicate with the justice department through text messaging. By sending the word JUSTICE to 311, constituents can enter into a conversation with the Niger Ministry of Justice's hotline and provide feedback about the Niger justice system.⁹

Other ways governments can provide better service to citizens and further engage them is to allow citizens to report problems like poor water quality, an obstruction in a roadway or a downed power line via messages and pictures through a text message or a post to a website — the GPS/GIS position can be automatically tagged so the citizen does not even have to give location details. Governments can also use social media as a tool to communicate with citizens. In countries where mobile adoption is pervasive, but constituents may not have a television or even a computer, public safety officials can provide updates through social media



Source: CDG/Governing Institute Enterprise Mobility Survey, 2013

sites to cell phones regarding dangerous weather or other emergency situations in addition to mass texts.

In the United States, cities like Boston are taking mobile technologies and citizen engagement to a whole new level. The Mayor's Office of New Urban Mechanics' more recent projects include an app that collects information from constituents as they drive, automatically, including the smoothness of the ride, which allows the city to see which streets need to be fixed. Adopt-a-Hydrant allows citizens to take responsibility for a city fire hydrant and shovel out snowed-in hydrants for the winter. Other cities — including Chicago and Honolulu — are developing similar initiatives. Projects like this not only save a city money, but also provide a sense of community involvement and give citizens pride in maintaining their city's infrastructure.

Close two-way communications may also help save lives. The state of Minnesota offers TXT4Life, a service where adolescents contemplating suicide can connect with community service personnel through texting chats. "Some areas in the state are having tremendous success helping kids with texting rather than a traditional hotline solution," Fleissner says. "This is an example of how we need to figure out ways to connect with our younger generation in modes they want to work with us."

2. Transportation

When asked how mobile devices and applications positively impact transportation, respondents ranked improved citizen satisfaction highest. For example,

real-time vehicle tracking and reporting by transportation departments allows for less traffic congestion and smarter route planning.

In addition, agencies can tap mobile technologies to streamline revenue collections from parking meters and other sources. For example, the city of Houston allows citizens to start a parking transaction on their phone and receive an alert when time is about to run out. Time can be added from the mobile app, which is sent to the handheld devices used by parking enforcement officers.¹⁰

In Seoul, South Korea, a city frequently acknowledged for its innovative transportation system, commuters use smart payment systems in the Seoul Underground. The systems use radio-frequency identification (RFID) and near field communication (NFC) technology for automatic payment, allowing travelers to pay their tickets with their smartphones.¹¹

The New York State Department of Transportation offers a mobile Web app that provides constituents with real-time information on traffic, transit and travel conditions. Commuters can get data about incidents, construction, special events and even access cameras, weather forecasts, alerts and travel times for bridges and tunnels.¹²

Other mobile technologies include:

- Real-time ridesharing, which matches carpool partners at the time a trip is needed through a smartphone application
- Mobile parking apps, which aid people in finding the cheapest parking spaces in cities like Chicago, San Francisco, Seattle and New York
- Multi-modal trip or journey planning, which helps commuters navigate different forms of transportation — including trains, buses, subways, ferries and even private taxis

3. Public safety

Police and law enforcement officials are turning to mobile solutions to enhance public safety and enlist citizens to be additional eyes and ears on the street to fight crime. For example, reporting new instances of graffiti benefits citizens beyond just cleaning up unsightly tags more quickly.

Timely alerts and photos sent via citizen smartphones can help police track gang-related activity, including when a group is pushing into a new territory. This early warning system enables police to quickly take action, such as

500M

smartphone users worldwide will be using a health care application by 2015.



2015



By 2018, 50% of the more than

3.4 billion

smartphone and tablet users will have downloaded mobile health applications.



2018

1 person =
25M

Source: U.S. Food and Drug Administration

beefing up manpower in targeted areas to suppress crime or turf battles before problems occur.

Examples like this help explain why nearly 90 percent of the survey's global respondents said mobile solutions can enhance public safety. In fact, when asked whether mobile technologies can enable an agency to better allocate resources to stop or reduce the loss of lives and property, 25 percent of global respondents ranked this as a top benefit.

4. Public health

Mobile health technologies have the potential to transform health care across the globe — and are becoming extremely popular with citizens, with more to come. According to the U.S. Food and Drug Administration (FDA) website, 500 million smartphone users worldwide will be using a health care application by 2015, and by 2018, 50 percent of the more than 3.4 billion smartphone and tablet users will have downloaded mobile health applications.¹³ Eventually, mobile solutions that monitor citizen health over the long term will provide needed data on health trends and patterns.

Mobile apps for public health provide benefits that cross multiple dimensions. Top-cited enhancements by survey respondents include electronic medical records and mobile case management, such as in-field diagnosis and treatment where traveling health care workers access the latest doctor's orders on their mobile devices and update patient data on the spot, rather than in the office near the end of a shift.

Other mobile solutions for citizens selected for having the greatest impact on public health included general health and

wellness support, dietary tracking logs, appointment reminders and dietary suggestions based on calorie counters or exercise guidelines. Remote patient monitoring devices — where the technology passes on data to the doctor or hospital — can help keep chronically ill patients with diseases like diabetes or heart issues out of the hospital, saving money and allowing them to be in the comfort of their own home. And patients with less serious conditions can use mobile solutions to lead more productive lifestyles.

On-the-move information access and communications mean health care services can be delivered anytime and anywhere instead of in a predefined place, such as a doctor's office. "In health care we are working towards better integration across the continuum of clinical care through public health and community programs," noted one survey respondent from the U.S. "Mobile solutions can help us help consumers and stakeholders make needed connections more effectively."

In developing countries, mobile technologies help provide health care to individuals who would otherwise have no access. People who face a medical emergency can connect with doctors and nurses in large cities for real-time instruction. Smartphones are also improving vaccine supply chains by allowing real-time data of stock levels in remote facilities. This helps ensure that vaccines are available when children come to be immunized. Additionally, health

care workers in the field can access health records remotely and can send text reminders to patients about needed immunizations, vaccines and follow-up care.¹⁴

In other areas that impact public health — including food service and safety compliance — mobile technologies not only give inspectors the ability to input information directly from the field, but also allow citizens to use smartphones to voluntarily provide information to the city about unsanitary food environments or unsafe working conditions.

Strategic Steps

The latest data about enterprise mobility in the public sector shows a wide range of benefits for citizens and agencies alike, but organizations also face challenges as they move to greater adoption of mobile solutions for their operations. At the top of the list for many government leaders is security and the ability of existing networks to handle growing volumes of data flowing to mobile devices. Fortunately, new technologies — including hardened data encryption capabilities, an updated Wi-Fi standard slated for 2014 and the new generation of mobility platforms — address some of the biggest roadblocks. This means government agencies around the world can embrace mobile solutions for the long term, and reap the rewards of its widespread benefits.

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Big Data and HHS

Data mining and predictive analytics will make social service agencies more effective.

No single area of innovation promises as much public value as the rapidly evolving areas that allow government officials to utilize data across agency and IT silos. These technologies, whether data mining or sophisticated middleware, produce three transformative changes — they can improve the ease with which citizens can access services, facilitate field worker problem solving and produce a foundation for answering big, predictive questions through data analytics.

Five years ago, New York City launched an initiative, HHS-Connect, to collect its social service data in one place. The idea is to allow clients to walk into different social service agencies without having to re-enter their information and complete duplicate paperwork. “We have a vision of a client walking into, for example, a homeless


shelter and not having to reapply your information if you had already been to the public welfare office or to the Administration for Children’s Services,” said Kristin Misner, chief of staff to the deputy mayor for health and human services.

Yet this first step should quickly facilitate further actions that make government benefits easier to obtain for those who qualify and more difficult for those whose actions produce waste, fraud and abuse. Data mining and predictive analytics will help overburdened social service agencies detect fraud and better provide and target services. In Los Angeles County, the Department of Public Social Services uses a series of algorithms to analyze its systemwide data and uncover possible anomalies. The department’s system offers a risk analysis of potential fraud within

California’s child-care program, allowing investigators to prioritize their caseload. The technology means the agency can take a proactive stance against fraud, as opposed to solely responding to tips on hotlines.

Big data also allows governments to target their social services to those most in need, a crucial goal as budgets have grown tighter amid the economic downturn. Buffalo, N.Y., has used data analysis to expand Operation Clean Sweep, a collaborative community program that provides a range of services at once, from graffiti removal to health care, to particular neighborhoods. City officials analyze 311 and 911 calls, as well as economic and neighborhood data, to identify candidate neighborhoods and understand what pressing issues must be addressed first.

Finally, mobility puts usable information in the hands of those who do the real work of government. Silo busting not only allows them to see information and complete forms in the field but soon will provide decision support as well. Indiana child welfare services, for example, will soon provide guided insights to welfare workers faced with very tough decisions in the homes of challenged children.

Public officials, so long restricted by vertical IT systems and vertical work, now can chart a path to much more effective services thanks to breakthroughs in the use of data. 

Stephen Goldsmith is the Daniel Paul Professor of the Practice of Government at Harvard Kennedy School and directs the Innovations in Government Program and Data-Smart City Solutions. He previously served as mayor of Indianapolis and deputy mayor of New York City.



FLICKR/MARK HILLARY



Story Bellows

co-director, Philadelphia Mayor's Office
of New Urban Mechanics

In October, Philadelphia announced a 12-week accelerator program called FastFWD, which will work with entrepreneurs to develop innovative projects to address public safety challenges. Story Bellows, co-director of the Philadelphia Mayor's Office of New Urban Mechanics, spoke with Government Technology about how the program will help the city embrace innovation and rethink public-sector purchasing.

1 What's wrong with traditional RFPs?

One of the reasons we don't necessarily think RFPs are the best way to engage the creative insights of entrepreneurs and some of the most effective problem solvers in our society today is that we prescribe a solution in an RFP. There's no opportunity for an entrepreneur or innovator to really work with a city through our traditional RFP process. To work on that, we are defining the problem correctly and ensuring that we also have access and exposure to the range of potential solutions.

2 How will FastFWD help foster innovation?

We're trying to go beyond the traditional city-vendor relationship or vendor-purchaser relationship, and look at how we can support entrepreneurs by opening up insight into the challenges we're dealing with every day and leverage the ingenuity of the entrepreneur to help us create solutions.

3 How will the program help reshape government procurement?

It's really front-loading the procurement process by bringing that engagement earlier on — during the problem-definition phase instead of saying, "Here we go; we need this specific solution."

4 Is it important for state and local governments to rethink their strategy on procurement, particularly with testing products before committing to purchase them?

Our take on this is looking at how we manage risk in cities. We have supported the notion of trying to pilot things as often as we can. So instead of saying we're going to deploy a solution, whether it's technology or nontechnology across a city, we believe in testing that out somewhere.

— Sarah Rich, Contributing Writer



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Quiet Zone

The **Robert C. Byrd Green Bank Telescope**, named for the late West Virginia senator, is located within the National Radio Quiet Zone, a 13,000-square-mile area designed to guard against electromagnetic interference with radio telescopes. Large enough to fit two acres of land within its giant dish, the telescope is as tall as the Washington Monument.

While the area lacks Wi-Fi or cell signals, the quiet zone isn't completely silent; some low-power broadcast radio stations are still allowed, as are emergency communications like ambulance and fire response services. The Green Bank Telescope, however, sits within an even quieter area of the zone, in a section of West Virginia that adheres to stricter interference rules. To keep the zone safe from possible interference, like Wi-Fi signals, National Radio Astronomy Observatory officials patrol a 20-mile radius of the telescope on a weekly basis.



**A LOOK AT
TECHNOLOGY
THAT'S SET
TO TAKE THE
WORLD BY
STORM.**



THE NEXT BIG THING

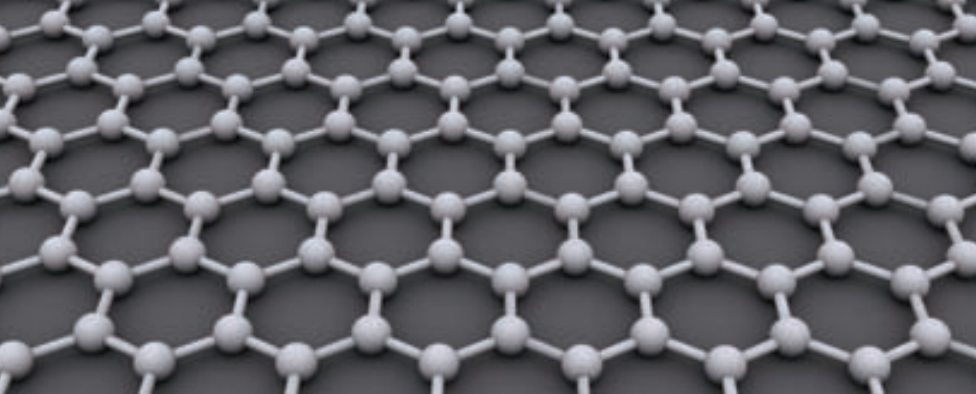
DANISH PHYSICIST Niels Bohr once reminded the world that “prediction is very difficult, especially about the future.” It’s good, tongue-in-cheek wisdom from the 1922 Nobel Prize winner, especially when it comes to technology.

Bohr realized that he had little chance of knowing that a century later, we would be “tweeting” and taking “selfies” with cameras in our phones, using information from a “cloud,” or controlling computers with our voices.

Seeing that far ahead is nearly impossible, but making educated guesses about the next five or 10 years is more realistic. Technology is iterative; the new replaces the old in fits and starts. PCs made big mainframes obsolete, and now smartphones and tablets are doing the same to desktops. Even applications like Facebook that are still thought to be relatively new could eventually be replaced by challengers like Instagram and Snapchat.

Which emerging technologies ultimately will rule the day? Only the future knows, but here are five that we think are promising and intriguing.

BY MATT WILLIAMS



GRAPHENE: A MIRACLE MATERIAL?

GRAPHENE, FIRST ISOLATED in a laboratory just a decade ago, sounds like science fiction. It's a "semi metal" that's extremely conductive to electricity. Amazingly thin and flexible — a latticework of carbon the width of a single atom — it's also been called the strongest material in the world. And it's responsive to all parts of the electromagnetic spectrum.

While it may sound too good to be true, before too long graphene will likely be inside computer chips, optical communications, biochemical sensors, spectrometers and many other products.

Researchers believe graphene could be used as the foundation of a new generation of computer chips that more quickly convert light into electrical current, enabling faster and more energy-efficient processors and rapid movement of vast amounts of data. Graphene also could play a role in new consumer devices, like an all-in-one camera that works not just in visible light but also other parts of the visible spectrum, like infrared and ultraviolet.

Other possibilities are flexible electronics, high-powered batteries, near-instantaneous smartphone chargers and ultra-safe water filters. The possibilities, seemingly, stretch as far as the imagination.

"It is a material that has unique capabilities; you have a metal that is extremely thin with good electrical properties," said Dirk Englund, an MIT physicist who is developing photodetectors that utilize graphene.

Photodetectors basically are sensors that detect light or other electromagnetic energy. A pair of night-vision goggles made using graphene could be as light as a pair of conventional sunglasses.

"The bigger vision is that we're trying to make all the active components in an electro-optic system out of graphene," Englund said. That includes the receiver, the modulator that encodes information on an optical signal, and the shutter. If successful,

such a system could make thermal sensors, chemical spectrometers and other high-tech gadgets so cheap and easy to fabricate that they become part of everyday life.

Still, breakthroughs are needed. It's tricky to incorporate graphene into devices, although Englund said labs are making progress "growing" graphene on a variety of substrates. In fact, big sheets of the material now are being made.

"It's amazing that only nine years after the material's discovery, there already exists many ways to fabricate it in different settings and in large scale," Englund said.



DIRK ENGLUND



JOHN ROGERS

ELECTRONIC SKIN: COMING TO A BODY NEAR YOU

NEW MANUFACTURING techniques are bringing forward a new class of wearable electronics that will give scientists, health-care professionals and even parents a new window into the human body.

Designed to be worn on the skin, these flexible exo-sensors could someday gather health diagnostic data, deliver medications and stick directly onto internal organs. It might sound more like fiction than reality,

but the age of electronic skin is right around the corner. The first frontier is health data.

John Rogers, a professor at the University of Illinois, leads a research group studying biomedical applications for flexible electronics.

The group's research spun off a new company, MC10, that recently introduced a product with Reebok called Checklight, a flexible tape that threads into the brim of a skull cap for athletes. The tape contains an array of

CROSSBAR MEMORY: UPPING THE ANTE FOR DATA STORAGE

COULD IT BE TIME TO SAY goodbye to flash memory and other tried-and-true data storage mediums? A new technology called "crossbar memory" can house a terabyte of data in an area about the size of a postage stamp — storing data 40 times as densely as the most compact technology available today.

Developed by University of Michigan professor Wei Lu, the term crossbar memory describes where the data is stored: Two layers of electrodes are stacked on each other, with a layer of "silicon switching medium" in between. The electrode rods of the top layer



WEI LU



FLEXIBLE TAPE EMBEDDED IN A SKULL CAP CAN QUANTIFY THE ACTUAL IMPACTS OF A BLOW TO THE HEAD.

accelerometers and gyroscopes that measures the physics of impacts to the head. The new product is marketed to football players and other participants in contact sports.

"It's not claiming to measure whether you had a concussion or not; it's measuring the severity of the hit," Rogers said.

Flexible electronics have been around for a while, notably in bendable OLED displays that are marketed as the next iteration of flat-panel televisions. But a key advancement in the evolution of electronic skin has been the development of silicon circuits that are stretchable like a rubber band. To do this,

researchers had to invent ways to use silicon in ultra-thin geometries that overcome silicon's natural rigidity and brittleness.

Rogers sees big things ahead in products like a skin patch that automatically takes a baby's temperature or a wristband that displays the wearer's heart rate. Futurists even think that these health-care applications could lead to the creation of flexible electronic skin for robots.

"Why stop at accelerometers? You could measure for temperature and hydration on that same platform. We're moving down a technology pathway to things that are more aggressive and more tattoo-like — ultra-thin film devices on the skin," Rogers said.

Google appears to be running with the tattoo idea. The tech giant reportedly filed a patent in late 2013 for an "electronic throat tattoo" that could communicate with smartphones and other devices, as well as serve as a lie detector by measuring the wearer's skin response.

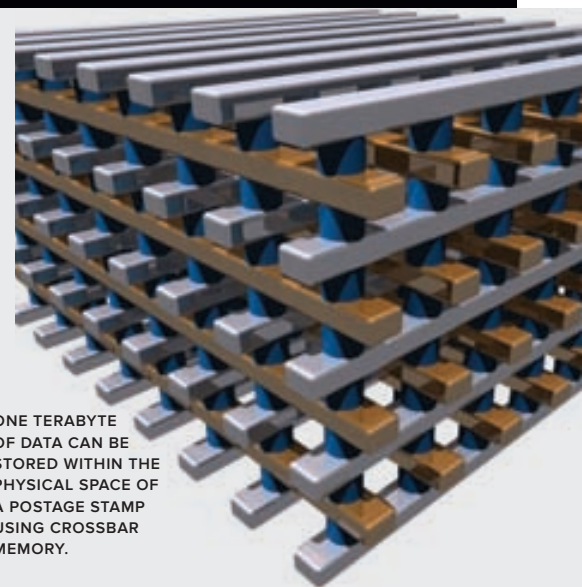
are oriented at 90 degrees to those in the bottom layer, which forms a grid. Pieces of data are stored at each of the junctions where electrodes from the different layers cross.

Lu is co-founder and chief scientist at Crossbar, a spinoff startup in Santa Clara, Calif., attempting to commercialize the technology. Demonstration memory chips of the crossbar technology are in development, and the goal is to have a manufactured product ready for the marketplace in two years, he said.

Dense data storage is one big benefit of the product, but the memory chip also will use significantly less energy. This means if crossbar memory were put in a smartphone, the battery life would be much longer. "It's not just for mobile, but also for sensors that are everywhere," Lu said. "It's costly to change the batteries of sensors on bridges and roads."

Lu also believes the way we do computing will fundamentally change, and crossbar memory might have a role to play. Today, the CPU and memory are functionally separate, but that might not always be the case. It might be possible to put crossbar memory locally next to the CPU, which Lu said would improve efficiency dramatically and allow for more powerful, more compact computing devices.

Crossbar memory is emerging at a time when makers of flash memory are having a hard time squeezing more capacity into smaller and smaller spaces. Moore's Law postulates that computer processing speeds, transistors, memory capacity and other factors tied to computing performance will continue to improve exponentially as time goes on — but that might not be realistic much longer.



ONE TERABYTE OF DATA CAN BE STORED WITHIN THE PHYSICAL SPACE OF A POSTAGE STAMP USING CROSSBAR MEMORY.

"Basically we have been making transistors smaller and smaller. But it's getting so small that we are running into fundamental limits," Lu said.



CO-PROCESSOR TECHNOLOGY IS DESIGNED TO LET USERS RUN HIGH-VALUE APPS CONTINUOUSLY WITHOUT DRAINING DEVICE BATTERY LIFE.

SMARTPHONE CO-PROCESSORS: NONSTOP DATA COLLECTION

CONSERVING A SMARTPHONE'S battery is a uniquely modern game of cat and mouse. Whether you're driving in an unfamiliar town or searching for a nearby coffee shop, many of us have felt the anxiety of having a low phone battery. Do you turn the phone off completely or risk continuing to use the phone's geolocation and mapping, knowing full well that it's a battery killer?

That probably won't be as big a worry in new smartphone models, thanks to a new generation of computer chips that offloads the phone's accelerometer, gyroscope and other motion-sensing gadgetry onto a separate "co-processor," which conserves the phone's battery.

Leading the way is the M7 motion-sensing chip in the iPhone 5s. Even when the phone is asleep, the chip can continue collecting data from the motion-tracking sensors.

"If your battery dies, no one's going to use your app, simple as that. What these co-processors will do is not drain your battery. You have a separate system that is doing some simple computation, and if something interesting happens, the main processor wakes up. You can be a lot more clever now about how you design apps," said Tanzeem Choudhury, an associate professor at Cornell University who directs a research group studying mobile health systems and activity recognition.

These new data chips could make fitness apps and other motion-tracking programs even more effective, Choudhury said. What's been missing is that these apps can't be left on 24/7 because they kill the battery. But new apps supporting M7 can measure always-on tasks like running or walking step counts in a pedometer. Other apps will measure when, where and how the user moved.

Besides improving health and exercise data, the M7 chip and other phone co-processors of the future could bring a new era of gesture controls. Imagine being able to answer a phone call by swiping your fingers in the air or fetching Siri by raising your hand. A gesture even could replace the passwords that now lock phones.

Gesture technology isn't 100 percent accurate yet, but it's improving. And some people might be annoyed that they have to make a motion instead of entering a numeric password. Others might be concerned that new computer chips like M7 will collect data about them even when the phone's in sleep mode. But overall the potential benefits are immense.

"People will use it if it improves their quality of life," Choudhury said.



TANZEEM CHOUDHURY



HEINZ WILLEBRAND, CEO OF LIGHTPOINTE, THINKS LASERS WILL PICK UP WHERE CITY NETWORKS LEAVE OFF, PROVIDING CRITICAL LAST-MILE CONNECTIVITY TO HOMES.

LASER NETWORKS: CLOSING THE BROADBAND GAP

THE UNITED STATES IS trailing many other industrialized nations in broadband speeds and last-mile connectivity, particularly in rural areas. Wiring the country with fiber might simply cost too much.

At the same time, the nation is trying to figure out how to deal with the looming wireless "spectrum crunch" driven by the booming traffic from smartphones and other mobile devices.

Maybe satellite and terrestrial lasers will be the answer on both fronts. Yes, that's right. Lasers!

Universities and corporate campuses have used optical communication — lasers — for a while in high-speed data links over short distances. The military first developed the technology, which most often utilizes infrared wavelengths near visible light on a part of the spectrum that isn't regulated by the government.

"The technology right now is migrating into an arena where the cost is going down, systems are getting smaller and more intelligent tracking technologies for the beam are coming," said Heinz Willebrand, president and CEO of LightPointe, a provider of short-range wireless bridge technology.

Optical communication has several advantages that could mesh well with consumers' increasing appetite for more bandwidth. There is more capacity in the unregulated optical spectrum than in the spectrum wireless carriers are subject to under the FCC, Willebrand said. Lasers also can bring up to 1 terabit speeds, which would make the gigabit networks that cities are installing obsolete. Optical communications also are secure, Willebrand said, because the beam is narrow, only a few feet wide when propagated half a mile.

"To get information from the beam, you virtually have to get into the beam," he said.

Like any technology, there are challenges. The lasers don't work well in fog, and they must be aimed precisely when traveling long distances. Even between buildings, the laser must be adjusted since the buildings move imperceptibly during different times of the day.

Willebrand foresees a future in which municipal wireless mesh networks bring fiber connectivity to a neighborhood's curb, and then nodes of lasers provide last-mile connectivity to homes. Hybrid fiber/optical networks also are possible, he said.

Lasers beamed from satellites could someday provide the connectivity that's lacking in many rural communities today. In October, NASA successfully demonstrated a download rate of 622 megabits per second with a laser shot from the White Sands Test Facility in New Mexico to the Lunar Atmosphere and Dust Environment Explorer satellite orbiting the moon. **GT**

3 DISRUPTIVE INNOVATIONS FOR THE ENTERPRISE

How will the workplace evolve for CIOs over the next few years? Carnegie Mellon professor Ari Lightman directs the university's CIO Institute, an education center that trains current and up-and-coming IT managers. Lightman identified three trends to watch.

1 USING THE 'SMAC STACK' TO COLLABORATE

It's undeniable that the SMAC stack — social, mobile, analytics and cloud — has fundamentally changed the business world. Lightman, though, believes that these tools are still underutilized.

"I think we're heading to widespread adoption of social tools as a productivity mechanism across the entire organization. These things are going to be as commonplace as when we moved to Internet-based technologies within the enterprise during the late 1990s," Lightman said.

Enthusiasts are using Yammer, Spredfast and other tools at work in sporadic pockets within organizations, Lightman said, but adoption is set to rise as the world becomes more comfortable with using one device that has both business and personal information on it for the sake of convenience.

To propel growth in this space, Lightman said agencies and businesses must figure out how to incentivize using the SMAC stack as primary tools, not just as optional add-ons that augment existing tools like email.

2 MEASURING EMPLOYEE PRODUCTIVITY WITH SENSORS

Forcing employees to wear an electronic device that tracks their every movement at work sounds like something out of a sci-fi horror story. But that could be the wave of the future as enterprises hope to improve service and efficiency beyond what's possible today.

"I think people are going to become sensor networks in the sense that companies are going to want to get information on how employees are being productive. It sounds like Big Brother, but

companies (and government agencies) will provide incentives to employees to understand and manage it," Lightman said.

Big companies like Bank of America have experimented with a high-tech name tag from Sociometric Solutions that measures how much a person talks and listens; tracks how much he or she sits, stands and walks; and records his or her physical location.

Lightman said employees could be agreeable to wearing such a technology if the data that's collected remains anonymous and the research leads to tangible improvements in their work lives. With further advances in the geolocation features contained in mobile devices, it could be as simple as using a smartphone app.

3 MAPPING CULTURAL NETWORKS

Who holds the power and influence at work? The answer could be revealed in a "cultural map" that measures social networks within an organization. Researchers examining organizational dynamics and behavior are now visually drawing the strength of connections between people in the workplace.

Each person on the map is a node; the map shows who has daily, weekly or monthly communication with one another, among many other statistical measures. With the data, managers can look at who is a central hub of activity and who is being left on an island.

"Often times the power is not actually where you think it is," Lightman said.

Cultural maps even could be valuable when identifying which people in an enterprise should be early adopters of a new technology. (Hint: It's the influential people.)

DOES 3-D PRINTING CHANGE EVERYTHING?

THE TECHNOLOGY IS FOSTERING INNOVATION FROM THE SPACE STATION TO ELEMENTARY SCHOOLS, BUT ITS IMPACT IS STILL A GREAT UNKNOWN. **BY DAVID RATHS**

If you plug the terms “3-D printing” and “government” into a search engine, you get lots of results about the potential regulation of 3-D-printed guns. Other stories focus on public-sector investment in additive manufacturing as an economic development strategy. But the technology may have far broader impact for the public sector.

Ultimately 3-D printing technology may transform the way almost

everything is made and procured — from gun sights for tanks to new livers for humans. And it’s already having an impact on city planning and emergency response.

A 3-D printer creates objects by depositing thin layers of material one after another using a digital blueprint until the component is created. The technology isn’t new, but largely because of the expiration of some patents, prices are falling so the printers are becoming

much more affordable. (You can buy a basic one online for around \$1,500.)

Originally developed to do rapid prototyping in the manufacturing industry, 3-D printing technology has advanced to the point that it now can do the actual manufacturing — and that’s what makes it a potential game-changer.

“Anything you can imagine you can print with no cost or complexity,” said Banning Garrett, senior fellow for innovation and global trends with the Atlantic Council’s Strategic Foresight Initiative (SFI) in the Brent Scowcroft Center on International Security in Washington, D.C.

“Something can be designed, manufactured and marketed all

Louisville’s **Ted Smith** with a 3-D model of the city.



What's the Right Regulatory Approach?

Although the public sector's intersection with 3-D printing will go far beyond regulation, there are indeed some issues the new technology will raise for regulatory agencies, including the questions about 3-D-printed guns and the Food & Drug Administration's oversight of 3-D-printed medical devices and implants.

In May 2013, Daniel Castro, senior analyst with the Information Technology and Innovation Foundation, wrote a paper titled *Should Government Regulate Illicit Uses of 3D Printing?* Castro believes the U.S. government should find a way to promote the technology while also ensuring that there are strong enforcement mechanisms and penalties to punish people or groups who abuse the technology by producing items that would be illegal regardless of how they were created.

The 3-D printers themselves aren't regulated now, he said, and no agency is in charge of overseeing them. It would be difficult for a regulatory framework to emerge about them suddenly, but things that are illegal now will still be illegal, Castro added.

"As with medical devices, there are certain limitations on how you produce things and those will continue. "We have some general agreement on things that shouldn't happen, such as making a bomb with a 3-D printer," he said. "Most everyone can agree on that, and governments and industry can work together on setting up a system whereby any attempt to make a bomb would be reported to authorities." As an example of the type of cooperation he is talking about, Castro points to the work of the Central Bank Counterfeit Deterrence Group, an international group of 32 central banks that provides support for anti-counterfeiting tools used by technology companies to reduce counterfeit currency.

by one person with little or no risk," he said. "You don't have to make it by the thousands and spend millions."

The technology is also poised to unleash a groundswell of innovation, since almost anyone with a cool idea and a low-cost printer can create a prototype and share it online via 3-D printing communities like thingiverse.com.

The ramifications of 3-D printing are likely to be felt in other sectors first — particularly traditional manufacturing and health care — but it'll influence public-sector technology decisions in multiple ways.

"It could have a huge impact on how [governments] buy and source products," said Yogesh Khanna, vice president and CTO of IT Infrastructure Solutions for CSC's North American Public Sector. "This is a fast-changing technology landscape and even things that may not appear to be immediately relevant to your job today may have a profound impact soon."

In fact, in several of the federal markets CSC works in, including defense and aerospace, 3-D printers are already being put to use. Khanna cited a recent CSC report that describes how a company called EOIR Technology used a 3-D printer to develop mounts for camera gun sights on M1 Abrams tanks and Bradley fighting vehicles. These high-precision components are mounted on the external body of the tanks, where they must survive shock, vibration and environmental conditions. The CSC report notes that by switching to 3-D printing technology, the company also reduced the manufacturing costs by more than \$60,000 per unit.

Khanna added that both the CTO and CIO of NASA's Jet Propulsion Laboratory are highly engaged in the potential of 3-D printing in space. The space agency is using the technology to solve one of its toughest supply chain problems.

Jason Dunn is CTO of Made in Space, a California company with a NASA contract to build a 3-D printer for use on the International Space Station this year.



MADE IN SPACE



"We started with the broader goal of enabling space manufacturing," Dunn said. "We are trying to address the problem of the constraint of launching things into space. The fact that it has been difficult and costly to get things into space has made it difficult to grow the space industry."

Made in Space tested several 3-D printers and found that extrusion-based printers, the type that are now becoming popular to print polymers, were the best fit. It received a Small Business Innovation Research grant to design a 3-D printer that could meet NASA requirements, including those around safety. "It is extremely



Made in Space CTO **Jason Dunn**, right, demonstrates 3-D printing technology that his company is developing for the International Space Station.

rugged and reliable to survive launch, and it is really easy to use,” Dunn said. “All the astronauts have to do is turn it on and the operation can be done from earth. We can send commands from the ground.”

A study conducted by NASA and the company showed that space-based manufacturing could solve numerous challenges. “We found that of all the parts that break on the space station, about 30 percent are plastic, and are good candidates to be 3-D-printed to make repairs or replace things,” Dunn said. “They use specialty tools such as wrenches made of plastic. They have things like camera mounts that

sometimes break. Also, the Space Station is a U.S. National Lab, and lots of experiments take place there. If an experiment has a problem, scientists on the ground need to work with astronauts to try to fix it quickly.”

The second Made in Space printer will go up in early 2015 for use by NASA, other governments, researchers, academia and entrepreneurs. “We really hope to democratize manufacturing in space to spawn new industries and discoveries,” Dunn said.

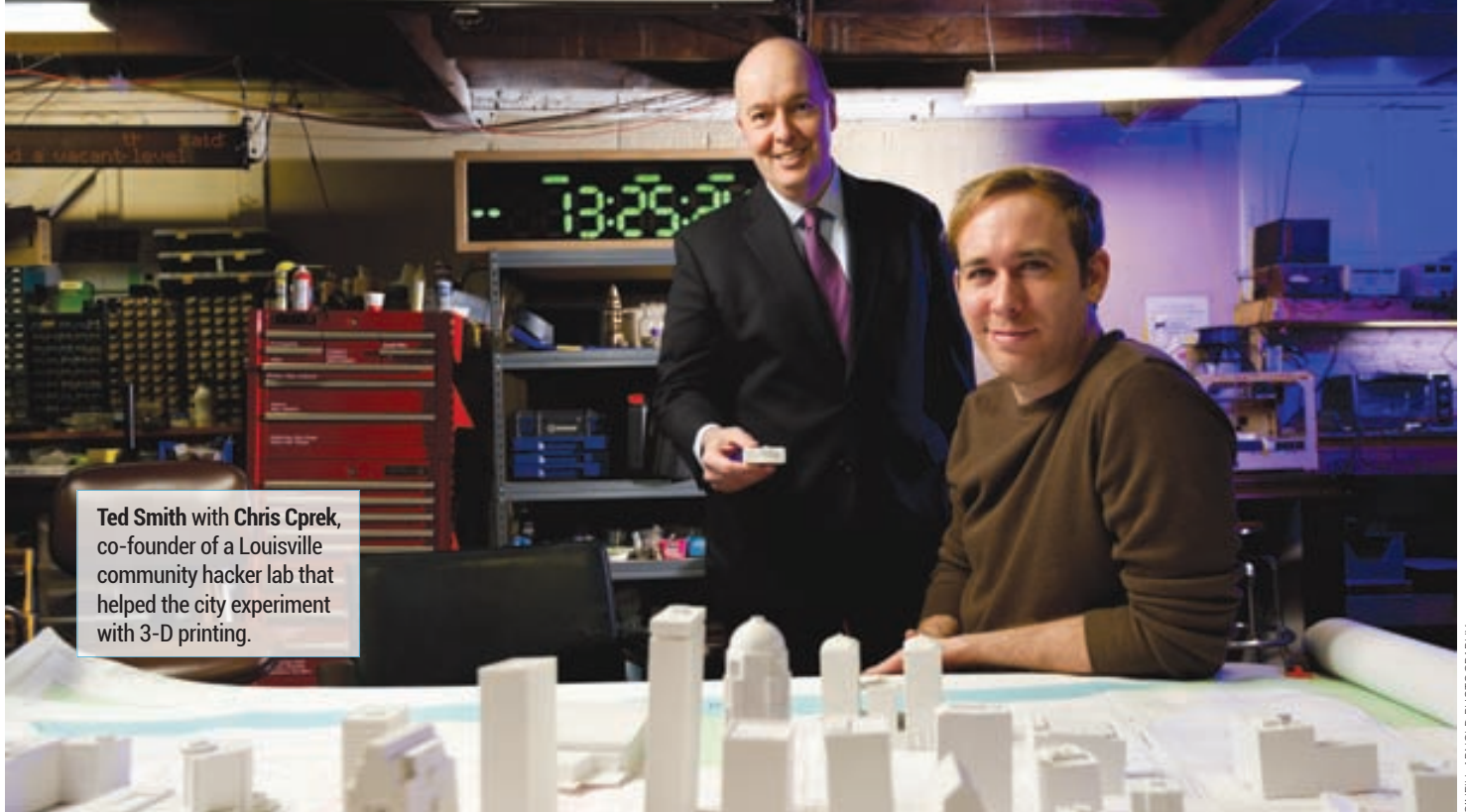
On the domestic front, the New York City Economic Development Corp. (NYCEDC) chose a company called D-Shape as the first-place winner of its

Change the Course — the NYC Waterfront Construction Competition, designed to provide innovative and cost-saving solutions for completing marine construction projects and maintaining waterfront infrastructure in New York City.

In announcing the award in April 2013, NYCEDC noted that D-Shape’s Digital Concrete resolves several issues regarding the restoration of piers, piles and seawalls that populate New York’s waterfront. By 3-D-scanning, then 3-D-printing concrete, the company can combine the best of precast and cast-in-place methods. “The advantages of quality control in fabricating off-site yet being able to closely fit the encasements, blocks or extensions to the surface that they are nestled into has a number of advantages, including lower costs, better quality control (thus longer life), lower labor mobilization and quicker delivery and installations,” NYCEDC noted.

D-Shape estimates that the city could save nearly \$3 billion by using the company’s technology across all 565 miles of its shoreline.

The U.S. Army Corps of Engineers also used 3-D printing during Hurricane Katrina to generate and regenerate models of New Orleans as the disaster evolved. “The models, which could be created in about two hours, showed changing flood-water levels, buildings and other features of the area,” the CSC report noted. “This aided in situational understanding and helped guide the relief effort as soldiers and civil authorities worked to save people and property. The 3-D mapping was critical for its visualization and speed.”



Ted Smith with Chris Cprek, co-founder of a Louisville community hacker lab that helped the city experiment with 3-D printing.

ONEILL ARNOLD PHOTOGRAPHY

So what are government officials thinking about 3-D printing? In September 2012, *Government Technology* wrote about how Louisville, Ky.'s IdeaFestival set up six 3-D printers so members of the public could share ideas using a 3-D model of the city and adjust the layout of the buildings to determine how alternate designs would look. One of the most valuable aspects of that experiment was to draw residents' attention to this new technology and to help them see the changeability of the built environment, said Ted Smith, Louisville's chief of economic growth and innovation. "People looking at a layout of the city or a map may think of it as static, and they have to decide whether they want to live there or not. But if they can see it as malleable and they can print out elements and place them on a board, it opens up civic dialog," he added.

Since that IdeaFestival, the six 3-D printers have made their way to schools and public libraries in Louisville. "As far as being a workhorse technology tool of the government itself, that gap is still big right now," Smith said. "Our planning department is not using 3-D printers every day."

But on the private-sector side, Louisville sees additive manufacturing as an

important aspect of economic development and many local companies of different sizes are exploring it, even a startup called Beam Technologies that makes a toothbrush with an app. "They can do product design modifications with a 3-D printer onsite," Smith said. "People can do their own fabrication and testing. That has implications going forward."

And there is exciting health-care work going on at the University of Louisville, he added. The Cardiovascular Innovation Institute, a collaboration between the University of Louisville and the Jewish Heritage Fund for Excellence, recently created and implanted parts of hearts in mice as part of their 3-D bio-printing research.

Other regional tech leaders are intrigued as well.

Professor Christopher Williams, who heads up Virginia Tech's Design, Research, and Education for Additive Manufacturing Systems (DREAMS) Laboratory, said the technology will lead to more entrepreneurial opportunities for young people. "Here at Virginia Tech we have a lot of smart students with neat ideas they sketch out on napkins, and they can do CAD drawings of them. But they need to make a mockup of ideas, and that

has always been an expensive hurdle," he added. "But the ability to make a model is now much more accessible."

One of the most powerful examples of the impact Williams could think of was a blind physics student who was studying 3-D calculus. "Her professor could print out spatial visualizations to make the concepts clear," he said.

Williams adds that K-12 students, who are digital natives, take to the new technology like fish to water. "They immediately grasp the idea of digital transfer of physical objects," he said. "It makes sense to them to receive a file and to print their next toy. In engineering we traditionally teach constraints, but these students don't know about those, and with these technologies there are fewer of them."

The Atlantic Council's Garrett predicts that within five years most students will have a 3-D printer in their classroom. "And just as at the time of the origin of the Internet, no one predicted Google, Facebook and Twitter, the same thing is true here. There will be many developments from the bottom up that we can't predict." **GT**

David Rath is a Philadelphia-based writer focused on information technology.



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ARE YOU READY FOR THE FUTURE? SMART GLASSES ARE JUST ONE TYPE OF WEARABLE TECHNOLOGY POISED TO CHANGE THE WORKPLACE.

IMAGE: APIMAGES.COM

Gettin' **IT ON**

**WHERE THINGS STAND
WITH WEARABLE TECH**

It's the plot to countless movies, TV shows and books — the moral, ethical and technological dilemmas that arise when man and machine merge. Cybernetic organisms, or cyborgs, serve as both the zenith of our technological potential and ultimate example of science gone awry. And while we're seemingly still quite far away from automatons sheathed in Arnold Schwarzenegger's skin, that hasn't stopped some enterprising, and possibly somewhat mad, "biohackers" from attempting to create rudimentary cyborgs out of their own bodies.

CHAD VANDER VEEN | EDITOR, FUTURESTRUCTURE

WEARABLE DEVICES LIKE GOOGLE GLASS INCORPORATE EXISTING TECH, WHICH COULD SIMPLIFY ADOPTION IN THE WORKPLACE.

FLICKRWILBERTBAAN

In a fascinating and slightly disturbing article that appeared in the August 2012 edition of *The Verge*, writer Ben Popper profiled biohackers who have taken to experimenting on themselves. From magnets to electrodes and sensors, biohackers are intrigued by the idea installing hardware on and in their bodies to see what, if any, sort of sixth sense they can then conjure.

For the vast majority of us, however, the idea of DIY surgery to cram devices under our skin remains far too off-putting to ever consider. But wearable technology, like Google Glass and Samsung Galaxy Gear, are driving more awareness and interest in devices that we can temporarily attach to ourselves. And while certainly a compelling concept, what can these devices actually do?

Google Glass

Google Glass is without a doubt the most well known example of a wearable device. The device resembles a pair of eyeglasses but features a heads-up display, a camera, voice-recognition, and cellular and Wi-Fi connectivity. Despite all the press it's received, Google Glass is still being tested and is not readily available to consumers. However, some 10,000 Google Glass Explorers have been selected to participate in a sort of live beta test.

As much as many people seem to be enamored with the idea of Glass, an equal number seem wary of the privacy implications it and other wearable devices present.

Understandably, some are not too keen on the idea of everyone being able to secretly video record everything all the time.

David Ciccarelli, CEO of Voices.com, a voice-over agency, is one of the Google Glass Explorers. Based on his experience with the device, he thinks the privacy concerns are overblown.

"Privacy implications have largely been over-exaggerated," he said. "Someone taking a picture with their smartphone, for instance, can be just as unobvious as someone taking a photo with Google Glass. In my experience as a Google Glass Explorer, people assume (incorrectly) that Google Glass is recording video continuously. As such, people

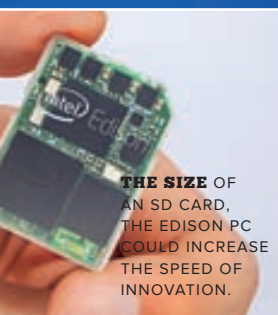
have been more cautious not to say or do something that could be recorded. Still, to start a video recording, I'd need to either be swiping and tapping through a menu to commence recording, or, audibly say, 'OK Glass, record a video.' Either way, people around me would have a good idea that I'm capturing footage."

If Google Glass is not designed for surreptitiously recording the goings-on around a user, what does Google have in mind for the device? Thad Starner is a professor of computing at the Georgia Institute of Technology and a wearable technology pioneer. He also is the technical lead and manager of the Google Glass program. Starner explained the actual features of Glass and what they might be used for.

"Glass is a lightweight wearable computer designed to be worn all day," he said. "To the user, the display is mounted high in the visual field, similar to the rearview mirror of a car. Glass is designed for short micro-interactions and is controlled via head motions, speech and a trackpad on the right earpiece."

Starner said his favorite thing to do with Google Glass is receive and send texts and email. "Suppose an incoming email is marked as being from an important sender," Starner said. "Glass uses a bone-conducting transducer in the earpiece to create a chime that I hear. If I am busy, I can easily ignore the chime, but if I am interested, I tilt my head up and the first lines of the email appear. I can dismiss the email with





THE SIZE OF AN SD CARD, THE EDISON PC COULD INCREASE THE SPEED OF INNOVATION.



MORE WEARABLES ARE ON THE WAY

WEARABLE TECHNOLOGY was front-and-center in January at the International CES, the consumer technology industry's glitzy annual trade show in Las Vegas. Intel CEO and event keynote Brian Krzanich, above, said a new generation of mobile and wearable technology is poised to hit the market this year.

"Most of my career, computing has been something you hold in your hand. Maybe it's something in your pocket [or] something that

sits on your desk," said Krzanich, who became the company's CEO last summer. "That idea is about to be transformed."

One of his announcements was Edison, a Pentium-class PC the size and shape of an SD card. Krzanich said the miniature computing marvel runs Linux, has built-in Wi-Fi and Bluetooth connectivity, and that Intel has designed an app store specifically for it.

Edison's processing power and small size could facilitate rapid innovation and product development during the next era of technology advancement. Intel plans to spur innovation with Make It Wearable, a contest for entrants to submit their ideas for wearable products, powered by Edison. The company will dole out \$1.3 million in prizes split among multiple winners and their entries. The top 10 contenders will work

with Intel and industry partners to develop the products for release.

Krzanich unveiled other Intel wearables that were geared mainly for consumer use, though some could prove useful at work as well. They included earbuds with biosensors, headsets that integrate with digital personal assistant software, and a bowl that charges wireless equipment placed inside of it.

—HILTON COLLINS, STAFF WRITER

ARMAGES.COM; INTEL.COM

a toss of my head or tap the trackpad to read more. If I want to reply, I say, 'OK Glass, reply' and speak my message."

For those who deal daily in large quantities of email, having access to messages attached to your head is likely either awe-inspiring or horrifying. Of course, it's not just email that Glass puts in your field of vision. Starner said the device makes many interactions as fast as checking the time on your watch — from checking the calendar, weather, traffic, time or stock price to taking a picture, recording a video, searching the Web or getting directions.

The idea of a true hands-free technology is certainly appealing to anyone who has ever battled for position to record a school play on their smartphone or anyone who has desired to navigate a city while actually looking at the surroundings instead of a handheld screen. And although Google Glass may be the most recognized wearable device, it's hardly the only one.

Health + Human Services

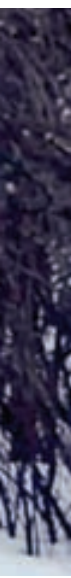
While Google Glass Explorers continue to test the limits of head-mounted technology, health and fitness buffs have enthusiastically latched on to wearable devices — or, more accurately, the technology has latched on to them. Fitness bands from Nike, Fitbit and Jawbone are becoming more common on the wrists of people interested in computing how much physical activity they're undertaking, how well they're sleeping and what steps to take to improve their overall fitness.

Leveling-up the wearable fitness technology game, a Montreal-based company called Hexoskin is getting attention for creating fitness garments with integrated textile sensors. This clothing, the company says, measures among other things a wearer's heart rate, breathing rate and volume, step count and cadence, activity intensity and calories burned.

General health and wellness is seen as perhaps one of the ripest markets for wearable technology. Beyond devices for gym rats,

there are a slew of innovative solutions for people wishing to improve their well-being. A company called LUMObac, for example, has a wearable posture-improving device that vibrates when a wearer is slouching. A number of manufacturers are working on wearable patches that offer transcutaneous electrical nerve stimulation for chronic pain relief. There are even ingestible devices being tested by Austin, Texas-based Freescale Semiconductor and Proteus Digital Health in Redwood City, Calif. These devices are tiny, cheap and digestible micro-controllers than can wirelessly transmit data about the goings-on in a user's guts.

One of the most interesting wearable devices currently available is the Tiger Eye Security Sensor. Developed by 10 for Humanity, the device is designed to deter violent crime and bullying before it can occur. The company's CEO, CJ Scarlet, is a rape survivor and victims advocate who champions the Tiger Eye Security Sensor as a discreet, hands-free way to call for



HEXOSKIN

help. The device, which is fashioned like a small piece of jewelry, automatically calls police when it detects keywords like “stop” and “no” and when elevated levels of stress are present in the user’s voice.

Despite these innovations, however, it seems in general that Americans are exhibiting tepid enthusiasm for actually using wearable devices. Several recent studies peg interest in the middling levels with, not surprisingly, the younger demographic being the likeliest to want or acquire the devices.

to the results of that survey, “when asked how long it would take for wearable technologies such as smart watches and Google Glass to become widespread at work or for work purposes, [in the U.S.] 22 percent said ‘immediately’ and a further 29 percent said when costs come down. Only 8 percent of the entire sample disagreed that the technologies would become widespread.”

It would seem that while there’s interest in taking steps toward cyborg-hood, it’s not yet overwhelming. This is good news for

Phil Bertolini, CIO of Oakland County, Mich., said he can easily envision a number of scenarios in which wearable devices could play a valuable role.

“Government is loaded with people who have to inspect property, businesses, etc.,” he said. “Imagine the ability to perform a hands-free inspection with data traveling wirelessly to a back-end system. If this is possible, I could see building inspectors, assessors, restaurant inspectors and code enforcers using this technology.

“Imagine public safety applications ... routing an officer on a 911 call, taking video and photos at a crime scene, capturing data for archiving purposes. A fire person could capture real-time intel as they arrive on a scene. If this technology is mature enough to allow the data to be offloaded wirelessly to a back-end system, then they may have something here. If the capture of data is strictly on the device, this may still work but may not be as effective. I think it would be very interesting to put this technology through a test to see if it is viable.”

Bertolini and others, of course, share concerns about privacy, security and governance. But this is an emerging industry that leverages existing bits of current technology to create something new. The adopted pieces, like cellular and Wi-Fi networks, already have robust security baked into them. Back-end support for the amalgamated technologies making wearable devices possible also is well understood. At this point in the evolution of wearable technology, it probably makes more sense to speculate about what might be accomplished with these devices rather than anguishing over what sort of support strategies are going to be required.

So for the time being, sign up for the Google Glass Explorer program. Get yourself a Fitbit or Jawbone. Eat one of those micro-controllers and see what data you can glean about your innards. Wearable technology is borne of innovation but will require innovative people to help it reach its potential.

Not everyone wants to become a cyborg or a basement steampunk surgeon, but some of these devices really might make our lives better. Maybe it’s time you got your technology on. **GT**

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WEARABLE TECH HAS THE POTENTIAL TO GREATLY IMPACT HEALTH CARE. THE LUMOBACK, FOR EXAMPLE, MONITORS A PERSON'S DAILY ACTIVITY AND VIBRATES WHEN HE OR SHE SLOUCHES.

According to the results of a Harris Poll of 2,577 U.S. adults surveyed online in September 2013, “nearly half of Americans are at least a little interested (46 percent) in owning a watch or wristband type wearable tech device, with over one-fourth specifying that they are very or somewhat interested (27 percent). While nearly half are at least somewhat interested in some other type of device (46 percent; 26 percent very or somewhat interested), fewer show an interest in owning a wearable tech device in the headset/glasses vein (36 percent at least a little, 20 percent very or somewhat).”

The poll’s results also suggest that younger Americans, who Harris terms “echo boomers,” parents with children under 18, and males are the demographics most interested in wearable technology.

IT security firm Fortinet conducted a 20-country survey of 3,200 employees ages 21-32 during October 2013. According

those responsible for supporting wearable technology when it does enter the workplace. Unlike other revolutionary technology changes, there may actually be adequate time to prepare.

The moderate pace of adoption also is good for government agencies that want to thoroughly consider how best to incorporate these devices. Clearly health and safety are applications at the forefront. How else might wearable tech make an impact in the public sector?

Wearing It Out

Much like the tablet computers and mobile phones that preceded them, wearable devices are believed by many to be a way to revolutionize field work — whether that’s building inspections, public safety or health care.



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Law enforcement agencies like the Fort Lauderdale, Fla., Police Department use big data solutions to layer crime data over other city information sources and social media posts to prevent crime before it happens.

WHO'S WHO IN BIG DATA

BIG DATA. The term is buzzing through the industry like wildfire, with vendors popping up in droves claiming their latest solution will help an agency increase efficiency. The concept seems simple enough — technology grabs data sets from a variety of systems and kicks back usage trends and other patterns that government leaders can use to help make better decisions.

But with so many products in the marketplace, getting a handle on all the options available can be a headache for even the savviest CIO. To help cut through the confusion, *Government Technology* took a look at 10 big data solution providers. Whether your data resides on an open source framework such as Apache Hadoop or a proprietary database system, the following list — presented in alphabetical order — offers a snapshot of the types of big data storage and analytical technology available today.

**THE MARKETPLACE
IS EVOLVING
RAPIDLY. HERE'S
A LOOK AT SOME
OF THE PLAYERS.**

BY BRIAN HEATON | SENIOR WRITER

CommVault

WHAT IT DOES:

CommVault's Simpana Platform lets users analyze, back up, recover, replicate, archive and search data across their enterprise and across any storage device, according to the company. The platform includes Simpana OnePass, which integrates archiving, backup and reporting into a single process to eliminate operational complexity and reduce cost. The products are designed to work on large-scale petabyte-level file systems and Microsoft Exchange messaging environments.

HOW IT'S DIFFERENT:

Emily Wojcik, CommVault's senior manager of product marketing, said the technology reduces scan times because backup, archiving and reporting are performed as a single operation, improving efficiency. "What

makes it very different from other vendors out there is that we've built this whole platform for data and information from the ground up," Wojcik added. "No acquisitions."

REFERENCE CUSTOMER:

The Afognak Native Corp., a quasi-public organization formed in 1971 to conduct business on behalf of Alaska's indigenous people, is a Simpana user. The corporation needed simpler, faster searching and retrieval of data to meet legal discovery requests. In addition, it wanted to improve its disaster recovery.

Using Simpana 9 software from CommVault, the corporation can now recover backed-up data within 75 minutes, and has an improved e-discovery system that integrates with Microsoft's Windows Azure cloud platform.

EMC Isilon

WHAT IT DOES:

EMC bills its Isilon platform as highly scalable storage for the big data era. Isilon is a storage and management solution for file-based, unstructured data such as audio content, video footage, large home directories, massive log files and analytical data in general. Capacity can expand from a few terabytes to 20 petabytes depending on need, the company says.

HOW IT'S DIFFERENT:

Audie Hittle, federal CTO of EMC Isilon, said scalability is Isilon's calling card for public-sector customers. Hittle said Isilon's architecture lets customers add capacity without rebuilding or replacing systems.

REFERENCE CUSTOMER:

Although Hittle couldn't name Isilon's premier public-sector customer, he described it as an "intelligence wing of a federal agency." He says the organization used Isilon to consolidate data storage equipment from 19 racks to three, and reduce the need for support staff.

IBM

WHAT IT DOES:

IBM's Smarter Planet initiative offers an array of big data solutions for public safety, transportation, social services programs, tax and revenue, and education. These products often include advanced case management and predictive analytics modeling capabilities.

HOW IT'S DIFFERENT:

IBM takes a program-specific approach to big data in the public sector. For example, the company works with state unemployment insurance programs to improve claims handling and automate processing of routine claims, leaving only complex matters for case adjudicators.

The company is also focused on how big data can be applied in K-12 education.

"We're involved in a number of initiatives that really are taking advantage of the explosion of digital content and its relationship to the classroom," said Gregory Greben, vice president of public-sector business analytics and optimization practice at IBM Global Business Services.



PREDICTING THE FUTURE

Big data ultimately could drive public policy innovation. As analytics capabilities improve and governments become more sophisticated in their data policies, predictive technology will become a powerful tool for decision-makers.

For example, public policy simulator Outline.com uses various metrics to visualize every aspect of a citizen's relationship with the public sector. Using census numbers, IRS information and other public and internal data streams, the application can provide users with a snapshot on how their policy ideas will play out before they are even formally proposed.

Bill Cull, Splunk's vice president of public sector, expects these types of applications to grow. "We're going to see big data questions come from outside of the IT arena," he said. "I think it's going to become part of

general knowledge that you can answer some really tough questions with big data."

Bobby Caudill, Teradata's global government program director, agreed, saying predictive analytics will drive a growing amount of government decision-making as IT departments gain big data expertise.

"It's really great to have these insights and a view of what's going to happen, but if you don't operationalize or execute on it, you're kind of missing the point," Caudill said.

REFERENCE CUSTOMER:

Police in Fort Lauderdale, Fla., use IBM technology to mash together traditional criminal justice data and information from other city departments to gain new insights on criminal activity. New analysis tools will let the city police department comb through traffic and transportation information, building permits and social media activity in addition to standard criminal justice databases. Correlating these diverse data sets could help the department anticipate where crimes will occur and put cops in the right places to stop them.

Informatica

WHAT IT DOES:

Informatica says its PowerCenter Enterprise product provides a platform for data integration initiatives like data governance, data migration and enterprise data warehousing. It scales to support large volumes of disparate data sources, the company says, turning raw data into actionable information.

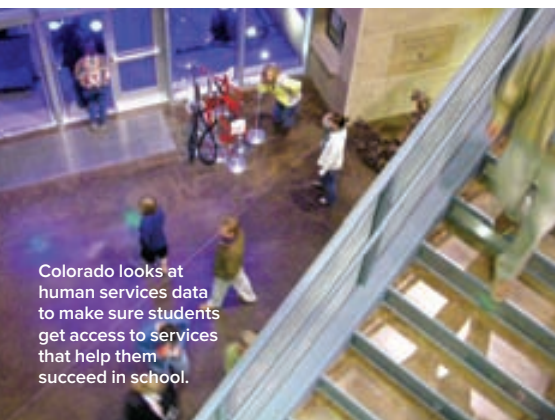
HOW IT'S DIFFERENT:

PowerCenter cuts development and deployment time by letting users integrate their own data in a shared graphical environment. The product is designed to help organizations take advantage of big data without requiring knowledge of specialized programming languages or frameworks, the company says.

"The data scientist can spend more time doing analytics and science, and they can turn over the more mundane tasks of pipelining the data in ... to somebody who knows data, but doesn't necessarily know Hadoop," said Todd Goldman, the company's vice president and general manager of enterprise data integration and data quality. PowerCenter also can automatically clean up "dirty" data produced by RFID sensors and other sources, he added.

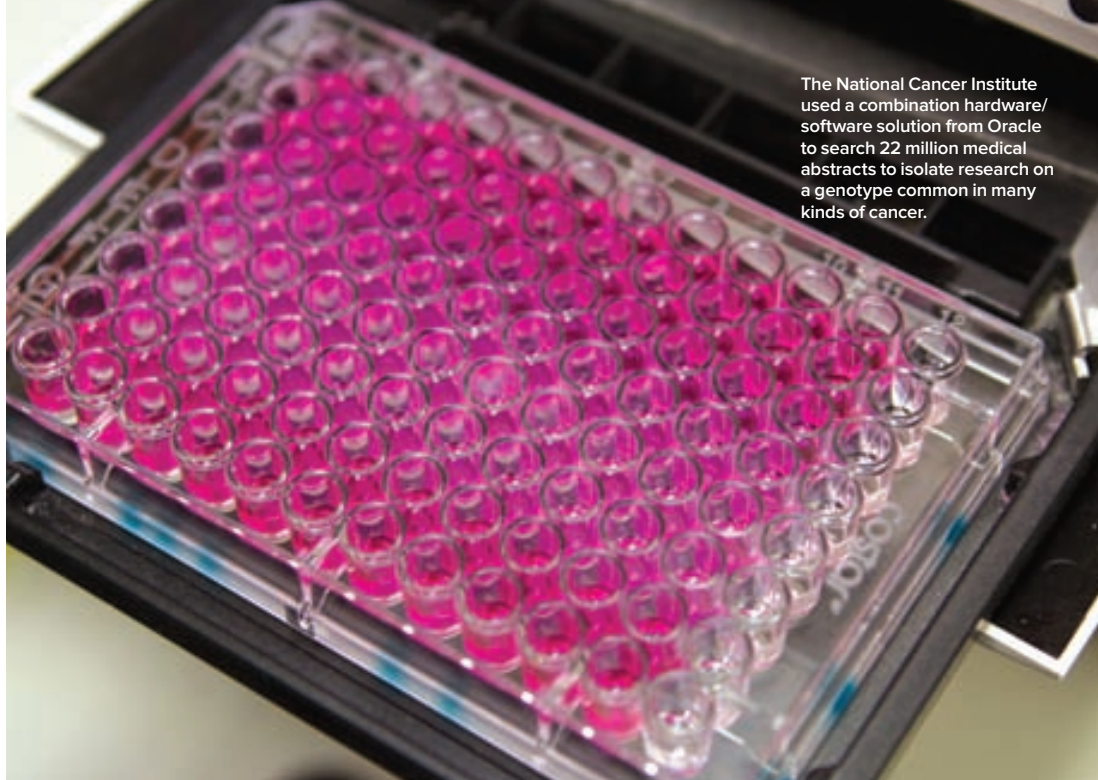
REFERENCE CUSTOMERS:

Informatica works with a variety of public-sector agencies, most notably the state of Colorado and the IRS. The IRS uses Informatica software to convert data from multiple legacy formats into useful information. Colorado is analyzing student data and human services information to predict student success, and to direct students to appropriate support programs.



Colorado looks at human services data to make sure students get access to services that help them succeed in school.

FLICKR/JESSICA LAMIRAND



CANCER.GOV

The National Cancer Institute used a combination hardware/software solution from Oracle to search 22 million medical abstracts to isolate research on a genotype common in many kinds of cancer.

Platfora

WHAT IT DOES:

Platfora Big Data Analytics is software that processes data in Hadoop and gives a visual overview of analytics from events, actions and behaviors.

WHY IT'S DIFFERENT:

Agencies can use Platfora software to illustrate relatively simple findings like the number of clicks a website receives by region, but the company

is focused on drilling deeper into data, said CEO Ben Werther.

The idea is to look at patterns of behavior across different streams of activity, Werther said, which could be particularly helpful for intrusion detection and other cybersecurity tasks. The software lets users observe net-flow and packet-capture data to spot suspicious activities. "We think that is meaningful — and business users, analysts and regular people can engage in a way that doesn't require everything to be a statistics problem, which it isn't," Werther said.

SAS

WHAT IT DOES:

SAS offers a range of big data capabilities, but fraud detection is a big emphasis for the company. The SAS Fraud Framework helps agencies detect fraud, waste and abuse. And the company's Visual Analytics solution is used by agencies to forecast demand for government services like Medicaid.

WHY IT'S DIFFERENT:

SAS software lets users access and analyze data from any type of source, said Paula Henderson, vice president of the company's state and local government practice.

For instance, SAS Fraud Framework includes an enterprise data management function that collects information from a variety of sources, cleans it up and analyzes it using SAS analytics technology.

REFERENCE CUSTOMER:

North Carolina used SAS technology to create the Criminal Justice Law Enforcement Automated Data Services, a platform that contains data about gun ownership, traffic violations, driving records and other information. Police officers can access the data on the Web, giving them better information during traffic stops and other encounters.

Oracle

WHAT IT DOES:

Oracle's Big Data Appliance is an integrated hardware and software solution for managing and analyzing large-scale data sets.

HOW IT'S DIFFERENT:

Oracle's engineered systems approach offers best-of-breed hardware and software components that are engineered and tested to work together out of the box, the company says. These pre-assembled solutions are designed to be more efficient and easier to deploy.

Mark Johnson, senior vice president of engineered systems for Oracle Public Sector, added that the company's Big Data Appliance

can tie existing data together without a steep learning curve. For instance, it can take old SQL databases and combine them with new technologies such as Hadoop and NoSQL, allowing users to access new data capabilities through a familiar interface.

REFERENCE CUSTOMER:

The National Cancer Institute (NCI) in the U.S. Department of Health and Human Services needed to search an unstructured data set of 22 million medical abstracts to correlate research studies of a particular genotype that figures prominently in certain cancers. Oracle's Big Data Appliance, built for Hadoop analysis, ran the query in three days, Johnson said, after the NCI's staff had spent weeks trying to analyze the data on its own.

Teradata

WHAT IT DOES:

Teradata provides cyberdefense analytic solutions; prevents fraud, waste and abuse; and improves government/citizen interactions.

WHY IT'S DIFFERENT:

Teradata offers a revenue share model for government agencies lacking the resources to invest in analytic solutions. The company will deploy an entire hardware and software solution for fraud prevention or similar function and finance the system by taking a percentage of revenue recovered by the new technology, according to Bobby Caudill, Teradata's program director for government.

REFERENCE CUSTOMER:

Caudill said 16 states use Teradata technology, including Michigan, which has been working with Teradata since the mid-1990s. In early 2012, the state estimated it was realizing an ROI of approximately \$1 million per day using the company's analytics technology, he said.

Splunk

WHAT IT DOES:

The company specializes in capturing and analyzing machine data — information generated by systems themselves. Splunk Enterprise software monitors and evaluates this data, giving agencies new insight into user behavior, system performance and cyberattacks.

HOW IT'S DIFFERENT:

Splunk software analyzes data produced by applications, servers, network devices, security devices and remote infrastructure and presents results in a visual format that's easy to understand. Splunk also offers a virtual store containing 400 downloadable apps for viewing data from various sources.

REFERENCE CUSTOMER:

One of the company's latest public-sector customers is the Texas Health and Human Services Commission. The agency uses Splunk software to analyze more than a terabyte of information daily, said Bill Cull, the company's vice president of public sector. The commission has 200 Splunk users spread throughout the organization, ranging from security and application teams to the deputy commissioner.

"We essentially provide insight into everything from servers, routers, switches, networks and all the way up to what we term operational intelligence where a government customer [is] able to see unprecedented insight into not only errors in the application, but also traffic and usage statistics," Cull said.

Unisys

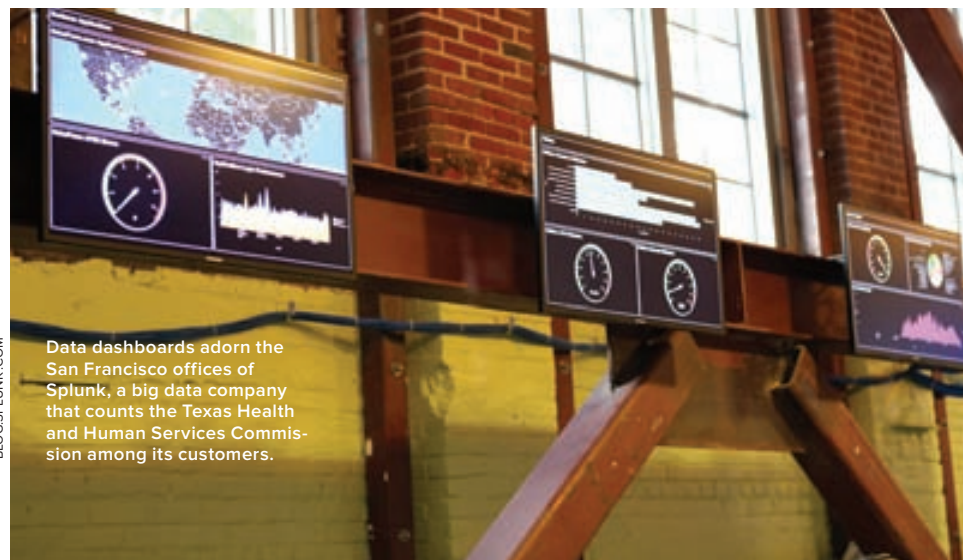
WHAT IT DOES:

Unisys offers what it calls "Big Data Analytics as a Service," providing data scientists and data analytics environments on public and private clouds.

HOW IT'S DIFFERENT:

The company reduces big data complexity by letting agencies outsource both the technology and expertise needed to take advantage of sophisticated analytics, says Rod Fontecilla, vice president of application modernization. Customers send Unisys their data and the company provides business insights and predictive models based on the information.

"People have realized that buying products doesn't solve your data analytics problems," Fontecilla said. "And getting a data scientist that really understands how to build predictive models is not easy — they're very hard to find and train. So the ability to have all that in one place, makes us kind of unique in the marketplace." **GT**



Data dashboards adorn the San Francisco offices of Splunk, a big data company that counts the Texas Health and Human Services Commission among its customers.

BLOG.SPLUNK.COM

The Traffic Sense

Utah tracks traffic and weather via thousands of sensors and cameras in its intelligent transportation system.

By Hilton Collins / Staff Writer

Lisa Miller doesn't know what her department would do without the cameras and sensors that monitor traffic conditions. Working as the traveler information manager for the Utah Department of Transportation (UDOT), Miller's feelings were confirmed two years ago when rough weather jeopardized part of the network.

In winter 2011, winds exceeding 100 mph bombarded overhead traffic cameras in northern Utah, which was bad news for traffic monitoring.

"It knocked out our camera coverage in the area where we needed it the most, and we've really come to rely on the network as our eyes and ears on the road," she said. "When we don't have it, it's hard to be effective and to give the traveling public the information they need."

More than 700 cameras and 1,500 in-road sensors record photos, videos and traffic data on state roads. UDOT, local news groups and national organizations use this information to communicate traffic information to the public. There are also several weather sensors, about 80 in Miller's estimation, that deliver weather information to drivers in the same fashion.

The public can visit the Utah Department of Transportation's traffic conditions home page to see the data, and a map

FLICKR/UTAH.UDOT



with icons depicting the locations where traffic cameras and weather sensors are currently mounted. Users can view photos of current road conditions and data on weather conditions. This information also is available on a smartphone app for Android and iPhone systems. UDOT reaches the public through social media as well, and the cameras, sensors and website information help employees keep citizens informed.

"We are very proactive at UDOT," Miller said. "Over the past couple of years, the traveling public has really turned to UDOT as a source, a provider [and] a partner."

Utah has full-time, in-house weather forecasters at stations dispersed throughout the state, and programs where drivers can call in to report road condition information.

A Closer Look

Most traffic cameras and sensors are located in the Salt Lake area where about 80 percent of the state's residents

live. The two types of equipment work together to gather data for the state's traffic operations center, and then that information is disseminated to the public.

UDOT's radar and loop sensors at intersections feed data to the department's signal engineers in almost real time. Pole-mounted radar sensors shoot microwave beams across lanes, and vehicles that are hit by the beams reflect microwave energy back to the antenna, which is how a computer analyzes changes in speed. The department also has vehicle inductive-loop traffic detectors beneath the pavement that detect vehicles passing over them.

The cameras, on the other hand, provide visual imagery to traffic control operators. They include standing detection cameras, telescopic cameras mounted on top of traffic poles and dome cameras, which sit and move inside of hemispherical glass domes.

Camera feeds, along with sensor data, help Utah's employees make informed

Flex lanes on 5400 South in Salt Lake City improve traffic flow by allowing the direction of traffic to shift according to commute patterns.

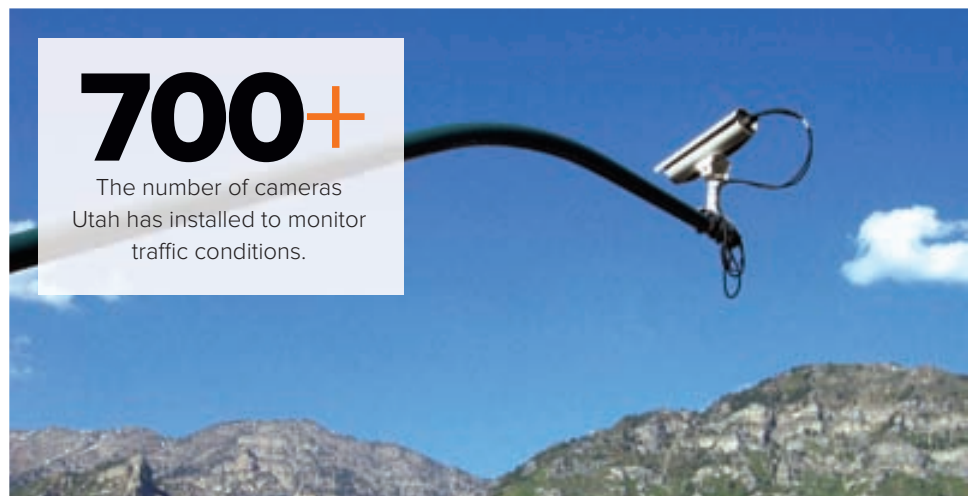


assessments about road activity. They use their knowledge to notify the public in multiple ways, including variable message signs.

“They watch congestion develop or dissipate and put messages back out to the public on overhead message signs warning of where congestion might be,” said Blaine Leonard, Utah’s intelligent transportation system program manager. “They can use that after a major ball game or a big Fourth of July celebration to sense what’s happening.”

The same statewide fiber-optic network that supports data transmission from cameras and sensors to the traffic operations center also supports data transfer from roadway weather information system sensors.

UDOT’s weather sensor network comprises various types of units. Traditional setups involve atmospheric sensors mounted on a structure near the road that



Flickr/Shawn Econo

communicate with ground-level sensors called “pucks” embedded in nearby pavement that read the temperature on the road.

There also are sensors mounted on poles near the road that fire infrared energy on a surface, allowing personnel to gauge how much light ice and snow reflect back from the ground. This latter group of sensors is called non-invasive because they don’t require installation on actual pavement in the middle of traffic flow.

Data gleaned from these sources allow UDOT to post up-to-date weather condition information on variable message signs statewide as well as through social media and government websites.

Foundation for Future Development

A combination of factors prompted Utah to begin deploying cameras and sensors at the dawn of the 21st century. It was a natural result of the evolution of traffic systems that had been under way throughout the 1990s.

According to Miller, the intelligent transportation system wave was rushing through the country at that time, and it influenced how cities developed their infrastructure, including Salt Lake City.

“The whole concept of intelligent transportation systems started to come alive at that time, and when you manage traffic more efficiently, it’s less expensive, it saves people time and gas,” she said.

Utah began installing cameras in the late 1990s, as Leonard recalls, and there were only a half dozen or so at first. The state was building a new intelligent transportation system in conjunction with reconstruction of Interstate 15 in Salt Lake County at the time, but that wasn’t the only impetus for increased use of traffic management technology. Soon

after, Utah was selected to host the 2002 Winter Olympics, and government leaders knew an influx of tourists was coming.


“That was sort of our start, and we’ve been adding cameras in our system continuously ever since then and replacing cameras as they wore out,” Leonard said.

Neither Leonard nor Miller could name a specific cost of the overall installation or management of their decades-old system because it’s been around so long and its growth has been tied to other state projects. The freeway reconstruction was billed at more than \$1 billion in the beginning.

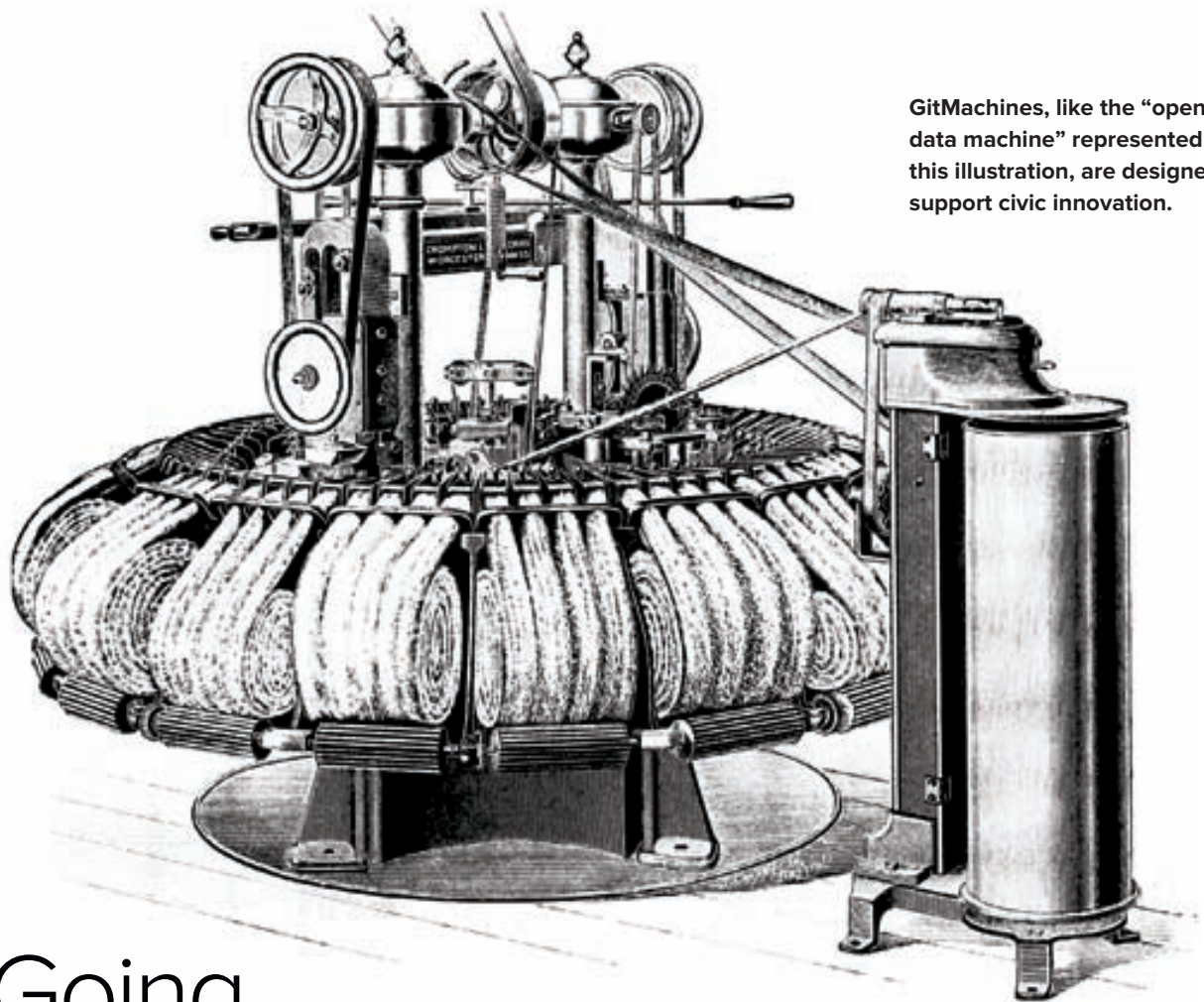
However, Leonard spoke generally about the cost of specific cameras and sensors. A typical camera costs about \$4,000, but it requires a pole and pole foundation to be built with it, as well as a cabinet with equipment inside that lets people operate the camera, which increases the total cost to about \$20,000.

Sensor costs vary because there are several kinds, many with different installation requirements.

It’s safe to say that Utah’s sensors and cameras will be integral to traffic operations for the foreseeable future, and the government plans to deploy more, especially in rural areas.

“You have plenty of weather information for urban areas, but you have very little when it comes to the rural areas,” said Jeff Williams, UDOT meteorologist and weather operations program manager. “Sometimes there’s a hundred miles between towns. A lot of times, these are trucking routes where you have to make sure that commerce is not impacted.” 

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GitMachines, like the “open data machine” represented by this illustration, are designed to support civic innovation.

Get Going

By providing servers in an open source environment, GitMachines enables the creation of apps compliant with public-sector IT policies.

By Sarah Rich /
Contributing Writer

Developers often face challenges when creating civic software applications or projects in an open source environment since they must remain compliant with government IT policies. In many cases, regulations like the Federal Information Security Management Act discourage public-sector IT administrators from adopting certain software and technology.

To help reduce the barriers between government and civic developers, GitMachines was created. The company, launched through a challenge by the John S. and James L. Knight Foundation in February 2013, provides a depot of open source, accreditation-ready servers that are

available for download from GitMachines' website, said Co-founder Greg Elin. The idea is that the servers can be up and running in minutes, allowing developers to use preconfigured tools like code repositories to innovate while keeping their applications compliant with government policies.

“If [developers] are coming from a very open world, and they move into the compliance world, it's a very big culture shock,” Elin said. “Your tools are restricted, and you can no longer self-service your needs.”

Elin said public-sector IT administrators often have cumbersome auditing processes they must complete before committing to a full-blown software deployment for their organization. To help government IT leaders with the decision-making process, apps and projects created using the GitMachines plat-

form can be tested first in a virtual environment before they are deployed.

Ideally, Elin said, GitMachines tools will be accepted as compliant more broadly so that IT administrators can simplify their auditing processes when accrediting a tool to use in their organization.

No government agency has adopted anything developed in the GitMachines environment just yet, according to Elin, but civic projects are already being created in the platform.

Avoiding Stalls with Installs

Open government technologist Waldo Jaquith developed a tool, The State Decoded, which when adopted by a public-sector organization can be applied to a website to help display all state and city

laws online in a simple, machine-readable format. Jaquith served as a judge for the Knight Foundation challenge that GitMachines won and was impressed with the tool's potential, so he found a way to integrate it into The State Decoded.

“If [developers] are coming from a very open world, and they move into the compliance world, it's a very big culture shock.”

After building The State Decoded as a stand-alone program, he modified it to require the use of Apache's Solr search engine, making the laws searchable. Because Jaquith didn't want people to have to install Solr in order to use the tool, he created a GitMachine to help speed up the install process for his tool. “GitMachines takes a multi-hour installation process and reduces it to a few commands.”

Last October, Jaquith announced via Twitter that a version of The State Decoded

was being packaged on GitMachines as a security content automation protocol, accreditation-ready tool. Down the road, the platform could have a one-click install through GitMachines for governments to adopt into their organizations.

Having that resource could then help public-sector IT developers create websites with searchable state law information.

Before working with GitMachines, Jaquith spearheaded versions of The State Decoded projects for select jurisdictions. In September, the OpenGov Foundation launched San Francisco Decoded, a tool powered by The State Decoded website that puts San Francisco laws online. However, San Francisco's version doesn't use any component of GitMachines.

The New Standard?

Members of the technology community like Elin hope that in the future,

open source technology will become more standardized for government use.

According to Pat Fiorenza, a GovLoop research analyst, it may take time for governments to accept open source projects into their organization, but new factors are forcing IT leaders to rethink the technology's value, including projects developed in GitMachines.

“The big challenge around budgets is driving so many discussions around IT and investments,” Fiorenza said. “And if people are starting to really look at open source as a viable option, I think it's going to escalate pretty quick, people exploring it and getting a better sense of adopting it.”

Elin envisions that GitMachines' projects will eventually be accepted as standardized configurations on a broader level, enabling governments to adopt meaningful applications without undergoing long and complicated auditing processes. “We want to drive forward that community standardization.” **GT**

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The TYLT RUGGD protective case for Apple's iPad Air features triple-reinforced corners and a micro energy-absorbing inner liner designed for impact distribution and shock absorption. The case also has a built-in collapsible kickstand that maintains the iPad Air's sleek shape while enabling hands-free viewing. The TYLT RUGGD is available in grey and black, or green and black for \$49.99. The tough case is also available for the iPhone 5C, Samsung Galaxy S4 and Motorola Moto X. www.tytl.com



◀ Workstation on the Move

The Dell Precision M3800 15-inch mobile workstation measures 18 mm thick and weighs 4.15 pounds. Dual-cooling gives the workstation maximum performance at all times. The M3800 features 10 hours of battery life and multiple storage configurations, including up to two storage devices, with a maximum of 1.5 TB of storage (hard disk drive, solid-state hard drive or solid-state disk), one 2.5-inch drive and one solid state Mini-Card storage device (mSATA). The workstation is equipped with up to 16 GB of memory and a fourth-generation Intel Core i7-4702HQ 8 threaded quad-core processor with up to 3.2 GHz clock speeds for running software. www.dell.com

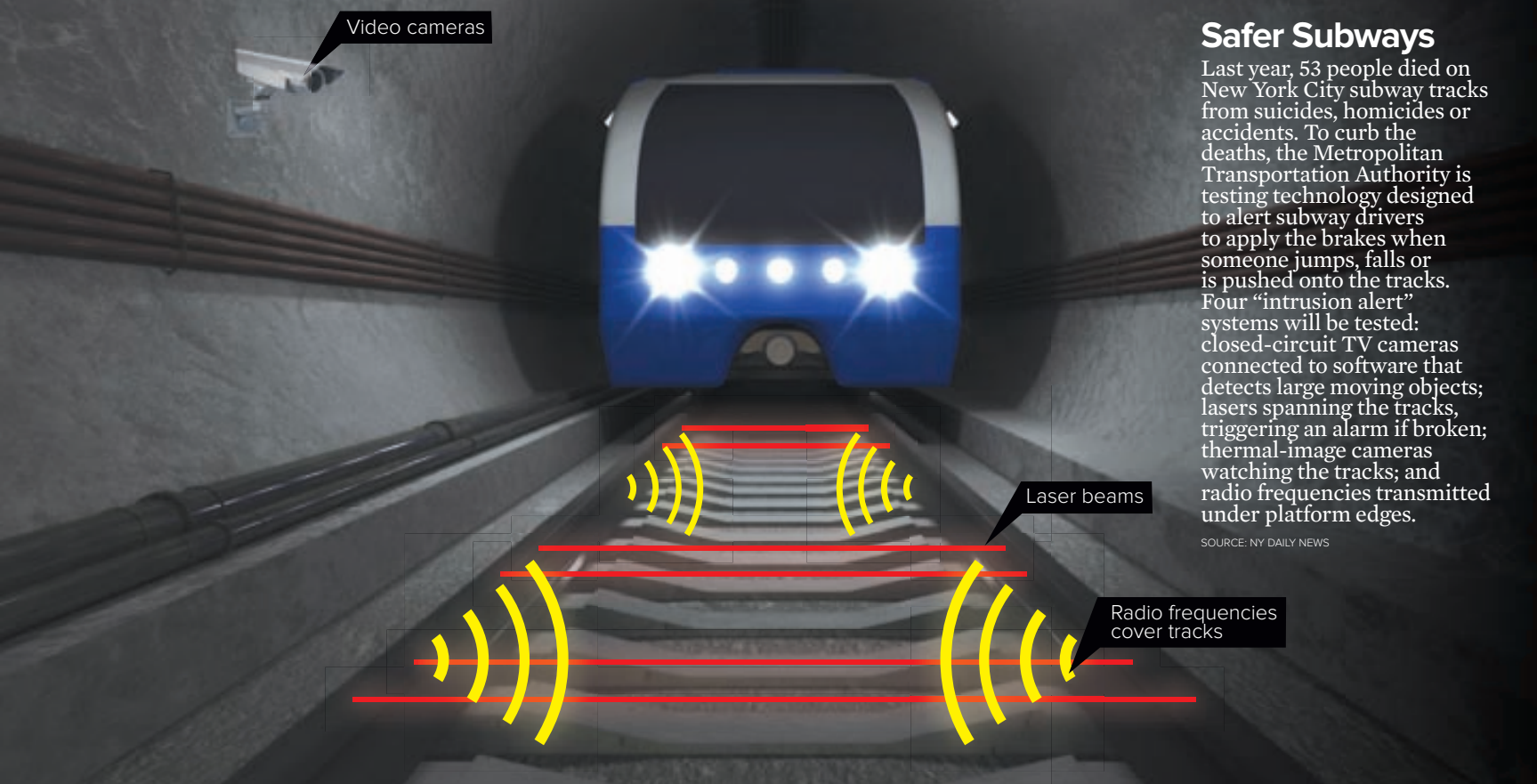


Ergo-Mouse ▶

The Oyster Mouse by Ergoption is a fully adjustable ergonomic mouse: One can instantly adjust the mouse to five different angles to intuitively find the best posture. Occasionally changing wrist positions helps users prevent repetitive stress injuries and most wrist discomfort, such as carpal tunnel syndrome. The mouse is designed for both right- and left-hand users, and works with Windows and Macs. The mouse adjusts to five angles, and all five of its buttons are programmable. Available in both wired and wireless, the wireless charges via USB cord (included) and doesn't need batteries. www.oystermouse.co



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Video cameras

Laser beams

Radio frequencies cover tracks

Safer Subways

Last year, 53 people died on New York City subway tracks from suicides, homicides or accidents. To curb the deaths, the Metropolitan Transportation Authority is testing technology designed to alert subway drivers to apply the brakes when someone jumps, falls or is pushed onto the tracks. Four “intrusion alert” systems will be tested: closed-circuit TV cameras connected to software that detects large moving objects; lasers spanning the tracks, triggering an alarm if broken; thermal-image cameras watching the tracks; and radio frequencies transmitted under platform edges.

SOURCE: NY DAILY NEWS

Measuring Rainfall with Windshield Wipers

Weather stations in various locations offer a reasonably accurate account of an area’s rainfall. But researchers at the University of Hanover in Germany think those samples might not tell the whole story. The RainCars project is based on the idea that the harder it’s raining, the faster the speed of a vehicle’s wipers. Gathering this data using GPS and wiper speed-monitoring sensors can help provide more precise information on where rain is falling most heavily. Even with variables like personal wiper speed preference, and car and wind speed, researchers believe a multitude of approximate data from cars can offer a better picture of overall rainfall than sparsely located weather gauges. SOURCE: GIZMODO

REAL-LIFE X-RAY VISION

Medical personnel now have the ability to literally see through patients’ skin to the veins underneath. The Eyes-On Glasses system from Evena Medical offers real-time 3-D imaging and anatomically correct visualization, clear

enough to locate even the faintest veins. The system also connects wirelessly to a hospital’s electronic records system, and includes digital storage and remote image-sharing capabilities.

SOURCE: INFECTIONCONTROLTODAY

DIGITAL DOCTOR VISITS

A pilot of a device called Teki from Accenture recently saved Basque Country, Spain, more than \$55 million U.S. by eliminating the need for about 52,000 visits to the doctor. The tech uses an Internet-connected Microsoft Kinect to link patients with chronic conditions to their doctors via video conferencing, voice communications or text messaging. Besides the Kinect, which hooks up to the TV, Teki includes a wireless heart rate monitor and a spirometer to track respiratory health. The system helps doctors identify issues early, often preventing hospitalization, and lets patients do rehabilitative exercises. SOURCE: GIZMAG



Managing Millennials

Five tips for working with the generation that will soon represent a majority of your workforce.

There's a new viral video making its way around called *Millennials in the Workplace Training Video*. While tongue in cheek, the video obviously struck a chord as it's rising up the YouTube charts with its depiction of the needy millennial always looking for praise and a promotion (and no meetings before 10 a.m.).

I wear dual hats because depending on the classification, I'm a millennial or Gen Xer, and now I am managing a team of more than 10 millennials.

So I thought I'd give my five tips for managing millennials.

1 / Structure Works When I first started managing millennials, I purposely gave them a lot of freedom on tasks. Personally, I've found that it doesn't work very well with most millennials. I've had much more success once I started providing clear directions, scope and deadlines. Maybe it's the structured childhood of activities they grew up with, but I've seen great improvements when I increased my focus.

2 / Share a Vision Many millennials have aspirations of making an improvement in the world. Public service is perfect for millennials — the missions are important and the work has great impacts. Make sure you share the vision with your millennials about how they are helping citizens (don't just tell them the tasks to do).

“Public service is perfect for millennials. The missions are important and the work has great impact.”

3 / How Do I Get an A? For most smart millennials, they've been trained their whole life to get an A. We all know work isn't that clear-cut, but it is helpful to show them what an A on the project looks like. At GovLoop, we moved to clearly defined goals for every project and once folks knew what an A was, there was increased alignment.

4 / Don't Assume There's an assumption from senior leaders that all millennials understand new technology, that since they are young, they get social media, blogging, smartphones and more. I've not found that to be true and find much variation within millennials, especially in using these tools in work environments. And I've seen that the variation goes both ways: I've had millennials be too serious and too informal in these new channels.

5 / Remember Yourself at that Age Many of the discussions about millennials are less about how things are different now but really about what it is like to be young, in your first couple of jobs and not having a lot of experience. The little things we've learned over time, they are learning for the first time. They might want a promotion after one year because it's 50 percent of their work career and feels like a long

time. If you are in year 15, your conception of what a work year is has changed dramatically. You have fond memories about how you were so much different at their age, but

really, what were you and your peers like right out of college? Ask your former bosses.

Millennials currently constitute 16 percent of the workplace, and by 2020 will represent 44 percent, so we have to pay attention to them. Take a chance and groom your next generation of government leaders — with baby boomers retiring, we need a new influx of talent in order to serve our citizens.

And don't worry about complaining; it's just part of human nature. The “greatest generation” complained about the baby boomers. Baby boomers complained about the slacker Gen Xers. And now Gen X is complaining about entitled millennials. In 15 years, millennials will be sitting around complaining about Generation Z. **GT**

Steve Ressler is the founder and president of GovLoop, a social networking site for government officials to connect and exchange information.





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