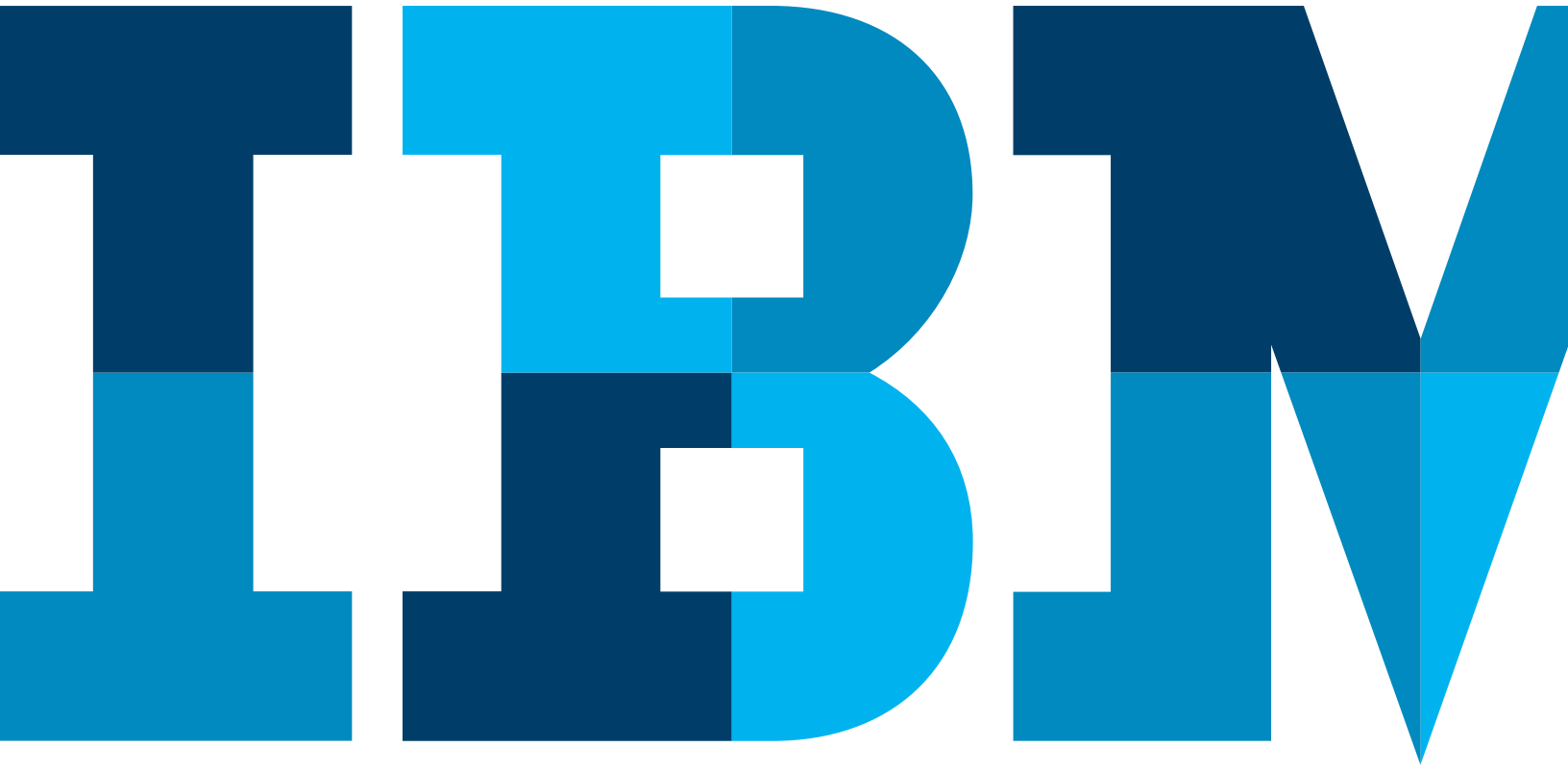
The economy of cloud

How cloud helps governments drive economic vitality



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Executive summary

Governments across the globe are being forced to do more with less. As they strive to meet increased expectations from digitally-savvy citizens—and promote economic health for their regions—many government agencies are looking to technology for answers. By moving key IT systems to the cloud, governments can gain benefits that extend far beyond the IT realm. In fact, cloud can assist agencies in driving economic vitality for their regions by helping control IT costs, improving citizen services and sparking operational and business model transformations.

Government challenges

Three global shifts

Central and local governments worldwide are adapting to powerful demographic, environmental and fiscal trends. Today's nations, regions and cities must compete to attract new residents, businesses and visitors by offering a high quality of life, efficient services and a vibrant economic climate. And they struggle to do this in an environment characterized by change, risk and the need for rapid decision making. In particular, governments are grappling with the effects of three global shifts: urbanization, aging populations and an evolving world economy.

In 2008, the global population reached a milestone with more people living in urban areas than in rural ones.[1] Urban areas typically need to offer efficient access to water, healthcare, education, and other social and cultural services. As such, urbanization presents challenges relating to financing the infrastructure (some of which is aging and in need of renewal) for existing and new citizens, adequately planning for land requirements and providing basic services — all in a way that strengthens social capital and preserves the integrity of the earth's ecosystems.

In addition to increased urbanization, governments also face the effects of increased life expectancy for their citizens. According to World Bank data, life expectancy at the world level has increased from 68.8 years in 2008 to 70.8 years in 2012.[2] This puts pressure on governments to increase spending on social programs like pensions, elderly care, etc. For example, the U.K. government spent £86.4 on pensions in 2005. In 2010, that amount grew to £116.4 billion and is expected to reach £149.7 billion in 2015.[3] Working-age populations must help support this growing number of older dependents; however, there are concerns that a shrinking proportion of working-age citizens (ages 15 to 64) could contribute to an economic slowdown. This, in turn, could create financial stress for social insurance systems, dimming the economic outlook for the elderly.

Finally, the world's center of economic gravity has changed over past centuries. Since the mid-1980s, the pace of that shift—from the United States and Europe toward Asia—has been increasing dramatically. According to McKinsey & Company, one billion people will enter the global consuming class by 2025, and around 600 million of them will live in emerging economies.[4] In addition, over the last two decades, a series of global recession and recovery cycles have been observed, including the recovery from the last recession in 2008, which is still occurring. However, future growth could be very uneven.

Changing expectations

In addition to global shifts, governments are facing fiscal pressures based on decreasing revenues and increasing expectations. Due to a rather gloomy worldwide economic climate, revenue for some governments is expected to stagnate, resulting in decreased budgets for citizen services. For example, The U.K.'s Local Government Association expects the total available for local governments to spend on services like social care, environment, etc. to decrease from approximately £50 billion in 2010 to £40 billion in 2020.[5]

In addition to tightening budgets, governments also face an evolving and more demanding constituency. Advances in social and mobile technology combined with the rise of more transparent—or "open"—government have further empowered citizens. Just as they demand more from products and services, today's citizens also expect more from their government agencies, including simpler processes and more efficient interactions.

Some governments also find themselves tasked with meeting expectations of non-citizens as well. The world is a smaller place today, with its inhabitants more mobile than ever. Many of these mobile individuals expect services from governments other than their own, such as EU citizens visiting or living in member states that expect social benefits from the host state. This obviously results in more expense for the state exchequer. The U.K. Department of Health estimated that its annual cost of treating foreign residents and visitors is up to £2 billion.[6]

Finally, in the face of increasing numbers of disasters, governments are realizing the crucial need for infrastructure resiliency—including IT systems.[7] Both natural and man-made disasters can result in large numbers of human fatalities and significant financial damage. In fact, the worldwide economic loss due to disasters in 2013 was US$140 billion.[8] Prevention of calamities and containment of damages are key challenges facing governments worldwide—and these agencies are incurring large planned and unplanned expenditures to address them.

The net result of all these challenges is that government agencies are tasked with providing more services with fewer resources. As they struggle to do more with less, many are turning to technology solutions, including cloud (see sidebar: Drivers of economic vitality).

Drivers of economic vitality

Long-term sustainable economic development is shaped by the value created by both people and businesses, leveraging technology as an accelerator for growth. The combination of people putting their talents to use within efficient and innovative public sector organizations is what creates value and economic growth.

The aim of economic development is to facilitate the balanced growth of business, talent and technology to enable value creation and innovation, as illustrated in Figure 1. In achieving this growth, cities, regions and countries also seek to realize positive environmental outcomes and grow in a sustainable manner that ensures the long-term well-being of citizens and organizations.

The primary enablers of an agile economy — talent and business — are developed through attraction, creation, use, growth and retention. Such efforts are accelerated by the innovation and adoption of technology.

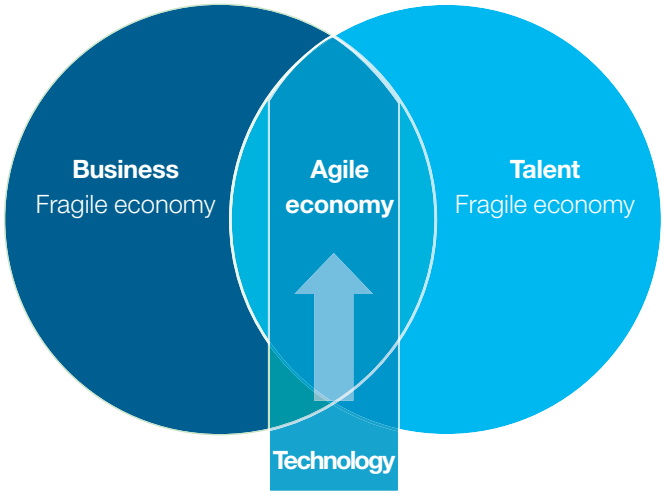

Figure 1: The three tenets of agile economies.

The cloud advantage

IDC predicts that by 2018, government will decrease traditional IT spending by 15 percent, redirecting that spending to the cloud.[9] We view this as a wise move, since cloud can offer benefits that aid not only in IT cost efficiency, but also economic development.

In addition to enabling flexibility and speed of response, cloud can also help agencies maintain the same — or even higher — levels of service with reduced funding and even serve as a revenue source. To understand how, it's first important to recognize cloud's capabilities and modes of service.

Cloud computing (or cloud) refers to the delivery of on-demand computing resources — everything from applications to data centers — over the Internet on a pay-for-use basis (see sidebar: What is cloud?). Cloud can help organizations reduce their IT costs and call on additional computing power, new applications or advanced analytical tools as required. In addition, software tools that are increasingly available for cloud also allow the rapid and cost effective development and deployment of new applications and, thus, new services.

There are essentially three cloud computing deployment models: public, private and hybrid. *Public* clouds offer rapid access to affordable computing resources to other organizations or individuals. A *private* cloud, on the other hand, is owned and operated by a single organization to bring cloud benefits to its various lines of business and constituent groups.

Private clouds exist to take advantage of many of cloud's efficiencies, while providing more control of resources and steering clear of multi-tenancy. Sometimes, a private cloud operator will allow other organizations to use its cloud in a shared services model. An example of this is the State of California, which plans to let any public agency in the state use its new CalCloud. Some public organizations are also considering allowing nongovernmental organizations (NGOs) or private companies from within their geographic areas use of their "private" clouds, as a contribution to the local economy.

Hybrid clouds use a private cloud foundation combined with the strategic use of public cloud services for workloads where control or confidentiality are perceived to be less of an issue or to provide emergency stand-by capabilities. Many organizations with private clouds will come to appreciate the flexibility of managing workloads across data centers, private clouds and public clouds—thereby creating hybrid clouds.

What is cloud?

Cloud computing is a pay-per-use consumption and delivery model that enables real-time delivery of configurable computing resources (for example, networks, servers, storage, applications and services). Typically, these are highly scalable resources delivered over the Internet to multiple organizations, which pay only for what they use. Cloud delivery models can help organizations scale their investments as they grow their business. They can also open the door to new business approaches through rapidly deployed standardized applications, infrastructure, testing environments and business processes that help improve service delivery speed and efficiency.

Cloud services

The three common models of cloud services are software as a service (SaaS), platform as a service (PaaS) and infrastructure as a service (IaaS):

- ***SaaS***: Cloud-based applications—or software as a service (SaaS)—run on computers "in the cloud" that are owned and operated by others and that connect to users' computers via the Internet and, usually, a web browser. Agencies using SaaS have no need to purchase, install, update or maintain software, as this is handled by the service providers. In addition, the service is able to dynamically scale to the usage needs of the agency, and cloud-based applications are frequently faster to implement and more flexible to adapt and update.
- ***PaaS***: Platform as a service provides a cloud-based environment with everything required to support the complete lifecycle of building and delivering web-based (cloud) applications—without the cost and complexity of buying and managing the underlying hardware, software, provisioning and hosting. This allows agencies to develop applications and make them available faster, deploy new web applications to the cloud in minutes and reduce complexity with middleware as a service. The growing trend toward modular software with published APIs will enhance the speed and flexibility cloud already offers.
- ***IaaS***: Infrastructure as a service provides organizations with computing resources including servers, networking, storage and data center space on a pay-per-use basis, often to run existing workloads.

For additional details about both the business and technical aspects of cloud computing, please see ibm.com/cloud.

Cloud benefits

Regardless of the service or delivery model, cloud offers some important key benefits to government agencies (see Figure 2).

Speed, agility and scalability

As touched on, cloud enables faster delivery of services and can help improve the agility and dexterity of government services. In addition, its scalability allows agencies to respond to peaks in demand for services. Governments with a cloud computing environment can rapidly deploy core applications and scale up or down quickly to meet fluctuating or even unpredictable demands.

Security

Obviously, all organizations want their information and systems to be secure. However, governments face particularly stringent security and privacy requirements. They are tasked with protecting sensitive information from unauthorized use while also providing the flexibility to allow critical information sharing between and among authorized users. As such, security is a source of concern for many governments looking to adopt cloud. However, with the right measures in place, information stored in the cloud is often more secure because systems used to manage cloud security are typically more robust than those used in traditional environments. Thus, with the right cloud management platform, authentication procedures and services framework, governments can guard sensitive data while also increasing collaboration within and among agencies.

Many organizations—in both commercial and government sectors—also rely on cloud computing solutions for continuity of operations (CoOp), primarily as an effective disaster recovery strategy. By storing data in the cloud, these organizations can create a continuity-of-operations plan in the event their local systems fail. Typically, cloud computing resources are located far from the specific operator, which makes continuity of operations easier in the course of man-made or natural disasters. In addition, there is growing acceptance of using multiple clouds to ensure recoverability of data in the event of a problem with any given cloud services provider.[10]

Cloud computing benefits for government

Speed, agility and scalability	Security-rich and highly available	Improved efficiency	Cost optimized
• Enable faster delivery of services. • Help improve the agility and dexterity of government services. • Scalability to meet demand peaks. • Replacement for lost skills.	• Facilitate improved data security. • Help better manage compliance. • Help improve disaster recovery capability.	• Help more effectively manage IT resources. • Enable reduced need for human intervention with automation. • Integrate functional "stove-pipes" — enabling sharing of apps and data.	• Enable improved IT efficiency and economies to reduce IT costs. • Shifts from fixed cost to variable cost. • Allow pay per use.

Figure 2: Cloud offers numerous advantages, particularly useful to governments challenged to do more with less.

Efficiency

Cloud can help governments more effectively manage IT resources; enable reduced need for human intervention with automation; and integrate fragmented, functionally divided organizations by enabling sharing of applications and data. Cloud computing helps organizations provision new applications or groups of users much more rapidly and efficiently. In addition, by allowing for rapid provisioning of resources without scale limitations, cloud enables a government organization to benefit from economies of scale without necessarily having large volumes on its own.

Cost

Cloud can help improve IT efficiency and reduce IT costs, as well as shift costs from fixed to variable. In fact, cost flexibility is a key reason many organizations consider cloud adoption in the first place—and is one of the more direct ways that cloud can help boost economic vitality, as we explore in the next section.

Redefining the possibilities

Cloud has great potential to help government agencies positively impact competitiveness and healthy growth for the regions they govern. We have identified three key areas in which cloud can help drive economic vitality:

- Controlling costs
- Improving efficiencies of citizen-centric services
- Transforming operations and business models.

Controlling costs

An IBM survey of business and technology leaders revealed that organizations—both big and small, across geographies and in virtually every industry—are embracing cloud as a way to reduce the complexity and costs associated with traditional IT approaches. Almost three-fourths of the leaders surveyed indicated their companies had piloted, adopted or substantially implemented cloud in their organizations—and 90 percent expect to have done so in three years.[11]

Cloud helps organizations manage costs by enabling a shift from capital to operational expenses. IT capital expenses—which typically include enterprise software licenses, servers and networking equipment—can be less fluid, more expensive and harder to forecast than routine IT operating expenses. In addition, cloud allows an organization to pay for what it needs when it needs it. This pay-per-use model can provide greater flexibility and avoid the need for redundant capacity—as, for example, when many tax agencies maintain large amounts of additional processing power and storage just to manage the tax-filing system that then sit unused for the rest of the year.

Cloud can also help governments save money on hardware and software costs. Cloud applications can reduce the need to build hardware, install software and pay dedicated software license fees, and there are potential cost savings associated with power and cooling, electricity and maintenance. In addition, moving to cloud frees up IT staff and allows them to concentrate on extracting more value from existing infrastructure. Rather than putting out fires or performing routine maintenance, IT can focus on more strategic initiatives, such as website improvements and building mobile apps for citizens. Also, SaaS cloud services make it more viable for employees to telecommute, as it allows them to access the tools they need when away from the standard office.

A recent MeriTalk report, "Cloudy with a Chance of Savings," found that government CIOs and IT managers had saved 7 percent of their annual IT budget by moving to cloud services. That number represents US$5.5 billion in savings based on the FY2013 IT budget of $78.9 billion. The report, however, points to a potential of 15 percent if cloud is fully adopted, and this figure falls in line with independent assessments from MIT's Center for Information Systems Research (CISR), which has studied the effects on IT budgets from technology standardization and consolidation across more than 100 organizations in the United States and Europe.[12]

Cloud also offers service delivery time savings because virtualization and service management software helps automate the service delivery process. This is one of the biggest cost-saving areas, with some organizations experiencing a 70 percent reduction in service delivery time.[13]

Another means of achieving cost efficiency is by implementing shared services across multiple government agencies, and cloud can be an enabler in the shared services journey. Because of its scalability, elasticity and pay-as-you-go business model, cloud provides a natural platform where multiple organizations can come together to share resources at an infrastructure (IaaS), platform (PaaS) and application (SaaS) level. Often cloud acts as a catalyst for business process simplification and standardization, which provide further cost savings opportunities.

The state of California's CalCloud initiative provides a great example of potential cost savings. The state teamed with IBM to build a cloud and shared services infrastructure, which is intended to reduce unit costs by 75 percent compared with current managed-services costs. CalCloud is also expected to drive improvements in service delivery quality and speed by removing policy and bureaucratic barriers to capital procurements, which have been under scrutiny since the financial crisis hit California. The initiative also intends to support state agencies and departments, plus the entire local community of municipalities, school districts, universities and counties in California.

Improving efficiencies for citizen-centric services

Cloud can help government agencies better respond to ever-changing citizen needs by enabling rapid adjustments to existing, as well as deployment of new, processes and services. Better tailored services that meet citizens' needs—and do so in a timely manner—improve quality of life, which improves a region's competitive advantage.

Many governments are relying on SaaS cloud services for basic office automation, payment systems, permitting/code compliance systems and web hosting. In addition, they can host finance, human resources and enterprise resource planning; public safety; and emergency management systems in the cloud. Other processes and applications that can be cloud based include property tax, asset management, traffic management, public transit, licensing, water/wastewater management and case management systems.

Moving these systems to cloud-based services allows government agencies to take advantage of cloud's speed, agility and scalability by making rapid adjustments in response to changes in demand, service needs, etc. In addition, hosting data using geographically remote cloud systems provides an excellent means of disaster recovery by protecting the data against natural catastrophes.

Cloud also provides a way for government entities to exploit the capabilities borne of today's digital trends to better meet citizens' needs (see Figure 3). For example, cloud can provide an excellent platform for analytics solutions because of its scalability for addressing extreme workloads. Big data and analytics can help governments glean insights relating to citizens' needs and whether current services are meeting those needs. In addition, cloud capabilities can allow governments to mine social media data to analyze public sentiment.

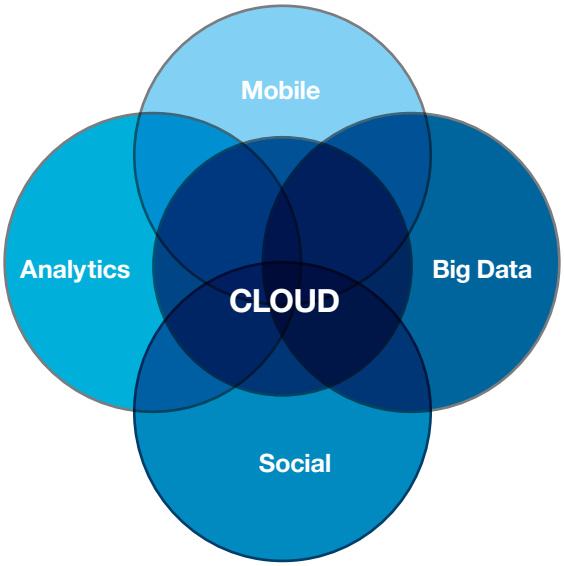

Figure 3: Cloud enables government entities to exploit digital trends.

Numerous governments also see their clouds as platforms for enabling mobile technology—and thus new forms of citizen engagement and self service. Mobile has moved to the forefront as one of the primary enablers for helping governments reach out to citizens. Cloud provides critical capabilities for rapidly developing these apps in an environment where workloads can be highly unpredictable. For example, one national ministry for social programs uses its cloud platform to quickly release apps for citizens.

Many rapid-development environments are now created specifically for cloud. In fact, the term "born on the cloud" has become synonymous with rapid, lightweight application development. With PaaS cloud services, timely application development is possible without the cost and complexity of buying and managing the underlying hardware, software, provisioning and hosting; thus, cloud-based applications designed to meet citizen needs can be deployed rapidly and cost effectively.

A Spanish provincial government that has teamed with IBM provides a great example of how cloud can improve citizen services. A key reason for the government's cloud implementation was to increase the quality of current citizen services, as well as introduce new needed services, without associated increased costs. The cloud solution should generate significant cost savings as well as increase efficiency of IT functions, allowing funds to be invested in other areas to benefit citizens. In addition, the cloud will enable IaaS and PaaS and also allow the government to offer a low-cost, accessible and secure platform, promoting IT expansion as well as the creation of jobs and companies.

Another story of cloud's ability to improve citizen services is that of the Karnataka Vocational Training and Skill Development Corporation (KVTSDC), an organization within the Department of Labour in India's fastest growing state. KVTSDC relied on cloud to help it create a program to help millions of citizens find work using their mobile devices. In India, only a small percent of the population has access to the web, but mobile phones and services are increasingly affordable and reliable. KVTSDC teamed with IBM to create a new cloud computing platform that helps connect job seekers and job providers, expands job searches, assists with cross referencing candidates, facilitates training and certifications, reveals emerging job trends and enables information sharing—all through mobile devices in local languages. KVTSDC expects this technology to increase the penetration of its programs and enable a vibrant employment ecosystem across the state.[14]

Transforming operations

Cloud also allows and sometimes forces governments to take a look at how they operate and ways in which they can transform. Specifically, we believe cloud can help drive transformations that create more efficient organizations, identify new revenue streams and create ecosystems and establish foundations for future economic growth.

Efficient organization

Governments often struggle with their own internal efficiency. Because of its intrinsic agility, cloud can help governments too become more agile. Additionally, the cost savings associated with consolidation of back-office operations can be directed toward improving front-office services.

For example, a European government pension fund wanted to gain faster access to its pension records in an effort to increase efficiency, raise service levels and better respond to citizens' requests for information. It partnered with IBM on an ambitious transformation project that leveraged cloud to replace two paper-based record systems with a highly efficient digitized archive. The organization can now provide instant access to millions of pension records.

New revenue streams

In addition to saving IT costs and improving citizen services, cloud can also serve as a revenue stream for forward-thinking governments. Entrepreneurial agencies could become cloud service providers themselves by offering services to other government entities or to local businesses.

A recent IDC report indicates that regional cloud—where one government agency offers computing and storage services to other agencies—could significantly change the way state and local governments procure online computing services.[15] In such scenarios, a state might provide cloud services for its agencies, enabling them to retire standalone systems and save money, or a county might serve as a provider for its peers within its region.

While the notion of shared services is not new, cloud takes it to a new level due to the additional capacity, volume and processing power—all readily available. Other governments are offering cloud as part of the public infrastructure—like water or utilities.

As an example of government becoming a cloud provider, consider the city of Wuxi in China: Wuxi worked with IBM to create a cloud computing center at the Wuxi New District iPark in China, a municipal research campus. The center offers emerging Chinese software companies the ability to tap into a virtual computing environment to support their development activities. The Wuxi cloud provides low-cost access to enterprise applications such as ERP, procurement, B2B portal and market analytics tools for small companies in the iPark.[16]

Ecosystem enablement

Governments do not work in isolation. They often interact with numerous varied entities—like other government agencies (and governments at different levels, such as local, state or central), departments, ministries, nongovernmental organizations (NGO), public-private-partnerships (PPP), franchisees, commercial businesses and, most important, citizens. Government agencies exist within an ecosystem in which an organization or individual either consumes value created by others or delivers value to others (see Figure 4).

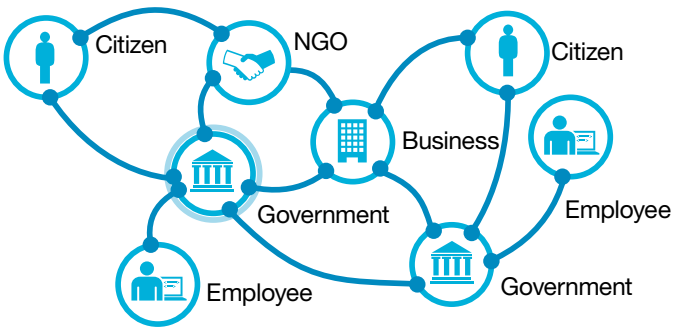

Figure 4: Government ecosystem.

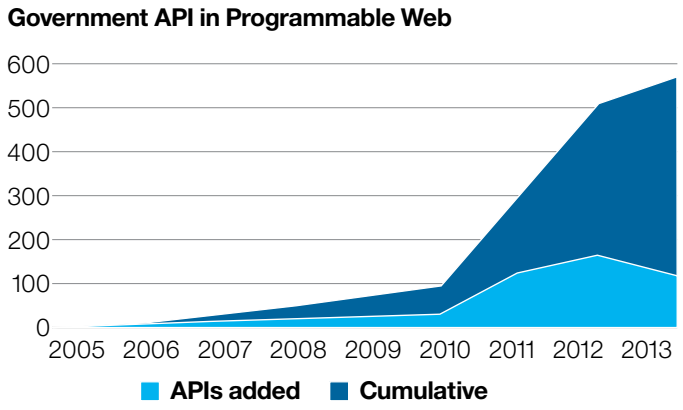

Figure 5: Growth of government APIs.

Source: ProgrammableWeb website, accessed June 2014; http://www.programmableweb.com/apis/directory

One way to offer value is by sharing information. In the quest to become more efficient and transparent to citizens, many governments are making more information available and open. Examples include the U.S. website Data.gov, the U.K. website data.gov.uk and the India website data.gov.in.

But governments are not stopping at just exposing data. They are unleashing value by exposing functionality from their own back-end systems through Application Programming Interfaces (API) that others can then use. For example, other government agencies may want to collaborate around a single integrated view of citizens to deliver social programs or physical assets to more efficiently manage transit systems. As depicted in Figure 5, the number of publicly available government APIs has skyrocketed in recent years.

In the Asia-Pacific region, a national postal service created a citizen identity authentication API, which it allows other government agencies to use as they create their own citizen-facing applications. IBM is helping a European environment and rural affairs agency develop a similar ecosystem through APIs that other agencies, as well as citizens, can tap for value. The agency also plans to create a marketplace where innovators and entrepreneurs from third-party organizations can create apps that use these APIs.

The way forward

The pervasive nature of technology today has contributed to higher expectations from a digitally savvy, more empowered citizen base. At the same time, governments are facing tightened budgets, forcing them to rely on innovation to do more with less. Looking to technology for solutions, astute leaders are embracing cloud. They have discovered that cloud can help them improve operational agility and enhance citizen value while aggressively controlling costs. These leaders use their improved agility and efficiency to enhance the quality of life for residents and visitors, as well as to drive overall economic vitality and sustainable growth.

Government organizations choosing to leverage cloud computing technologies to improve economic vitality—whether merely to reduce budget burdens or as an engine of more transformational change—should develop a well-defined roadmap to guide their journey. We suggest they start with the following:

- Identify common operations—HR, finance, procurement, licensing, etc.
- Establish policies that explicitly address both data residency and data sharing.
- Define the organization's cloud strategy, considering private, public and hybrid (or "dynamic") cloud along with the evolving operational models supporting "composable business" for government.
- As the anchor organization hosting a private cloud, identify other agencies, organizations and/or governments that would benefit as "consumers" of the cloud-based IT services and applications, effectively becoming their cloud service provider.
- On-board the "client" agencies/organizations, bringing their applications and data on board to reduce risk and ensure stability.
- Implement a common security and digital branding model across the services as the client agencies and organizations come on board.

While governments will increasingly rely on cloud, there are conflicting requirements that must be addressed and resolved. On one hand, governments embrace cloud to share infrastructure, platforms and information as a means of fulfilling their goals of transparency and efficiency. However, at the same time government policies demand data security and privacy as defined by their policies and regulatory compliance requirements. Thus, a policy-sensitive approach must be the foundation for any cloud computing initiative.

As demonstrated, cloud solutions can help control IT costs and achieve new levels of efficiency. But we've also seen how governments are using cloud computing to move beyond their goals for operational efficiency, to establish new sources of revenue and create new value. Altogether, cloud is helping governments improve both the development and delivery of citizen-centric services. As pioneering organizations are discovering, government leaders who choose cloud are transforming the business of government as they help steer their region toward a vibrant, healthy economic future.

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