Cloud Computing Advantages in the Public Sector

How Today's Government, Education, and Healthcare Organizations Are Benefiting from Cloud Computing Environments

White Paper

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What You Will Learn

Cloud computing is a disruptive technology model that is changing the way public sector organizations consume information and communications technology (ICT), and how they deploy and deliver services to stakeholders. A trusted network infrastructure is the foundation for any successful cloud implementation. This paper briefly reviews the status of cloud computing in government, education, and healthcare organizations. It also helps make the business case for a cloud implementation by summarizing the chief advantages and business drivers. Case study snapshots describe how public sector organizations have successfully implemented cloud services models in various environments worldwide.

Public Sector Forecast Calls for Cloud Computing

The public sector has always looked for ways to deliver better services within the confines of tight budgets. The global recession has put additional pressure on these organizations to streamline their operations and cost-justify their investments. As a result, ICT staff is facing difficult tradeoffs (Table 1):

Goals		Competing Goals
Expand services for stakeholders	>>>>	Controlling ICT operating costs
Improve internal operations	>>>>	Driving interoperability among agencies/ departments
Hire and retain top talent	>>>>	Managing budget pressures
Increase collaboration and access to information		Helping to ensure privacy and security

CIOs in government, education, and healthcare organizations have been quick to explore new approaches that increase operational efficiency and productivity, while at the same time maximizing investments and lowering costs. With its emphasis on consolidation, virtualization, and automation, cloud computing has emerged as an important strategy for achieving these goals. When chosen carefully and implemented properly, a cloud deployment can help CIOs perform the "balancing act" required to resolve critical tradeoffs.

Cloud computing is taking the public sector by storm as ICT professionals gain more confidence in this still-evolving technology and discover the many ways it can benefit their organizations. They are moving to eliminate expensive and inefficient information silos, but in doing so they have legitimate concerns about maintaining service availability and data security. All this is part of a major trend away from concentrated asset ownership and toward shared-resource ICT environments.

Collaboration applications, particularly email and web conferencing, tend to be at the top of the to-do list for cloud service deployments in many public organizations because they can be easily adapted to a cloud model. Mobile employees and teleworkers benefit from these applications because they can access them from anywhere, using a variety of devices. Virtual desktops facilitate the advantages of cloud-based applications.

> "If an agency wants to launch a new innovative program, it can do so by leveraging cloud infrastructure without having to acquire significant hardware, lowering both time and cost barriers to deployment."
>
> —United States Federal Cloud Computing Strategy

In addition, administration, office productivity, program/project management, and content management applications have become good candidates for clouds, particularly private and hybrid infrastructures. Customer relationship management (CRM) and specialized, custom-built applications are also getting the cloud treatment. Cautious organizations often start by moving noncritical business applications or discrete pilot projects into a cloud environment, and then follow that up with mission-critical applications as they refine and gain confidence in their cloud infrastructure.

Because cloud environments are based on a consolidation of resources, they tend to encourage integration of skills within data centers. Instead of separate teams that focus exclusively on the network, servers, security, and storage, the cloud paradigm encourages ICT groups to adopt a service management model in which expertise is pooled and tasks are undertaken in concert.

Case Study: Australia's National Science Agency

The **Commonwealth Scientific and Industrial Research Organization** (CSIRO) is Australia's national science agency, one of the largest research agencies in the world. Many locations around the country implemented standalone systems and scientific applications that had to be managed locally, creating more work and duplicating expensive resources. Best practices, such as system failover, were also sometimes lacking. CSIRO saw an opportunity to standardize the infrastructure and consolidate applications so that data could be managed, secured, and shared across all the sites based on industry-standard practices. Cisco provided key equipment and Cisco® Services offered the requisite expertise to implement the consolidation and virtualization plan. The engagement included a requirements workshop to define needs, knowledge transfer for operational tasks, a test bench, a high-level design, and a run book. Now almost 100 percent of CSIRO's business applications are virtualized, and work is under way to do the same with databases and other critical applications.

A Growing Global Trend

Clouds computing and virtualization—making physical location irrelevant to resource allocation and service delivery—are key components of many e-governance strategies worldwide. Governments at all levels, as well as educational institutions and healthcare organizations, are exploring cloud technology options and adopting a cloud services approach in a wide range of locales and ICT environments.

For example, the United States Government has instituted a Cloud First policy, with a significant portion of its annual US$80 billion in ICT spending devoted to cloud solutions in the future. The federal government plans to use virtualization to consolidate some 2000 data centers into about 1200 in the next few years, reversing a trend that saw the number of data centers swell from just 432 starting in 1998. The Canadian Government is following suit, announcing in August 2011 that it will shut down more than 90 percent of its 300 data centers as part of a consolidation effort called Shared Services Canada.

In April 2011, a Norwich University survey of nearly 650 ICT professionals in municipal, state, and federal agencies and higher-education institutions in the U.S. found that 46.2 percent of those responding are in the process of implementing cloud technology. Of 167 federal CIOs and ICT managers recently surveyed by MeriTalk (18 April 2011), 64 percent plan to adopt a Cloud First policy in the next two years.

Cloud computing is also on the rise in the European Union. The EU's cyber security agency ENISA has concluded in a report that private and community clouds best fit the needs of public administrations that want to achieve the highest level of data governance. The report recommends "a European Governmental cloud as a supra national virtual space where a consistent and harmonized set of rules could be applied, both in terms of legislation and security policy and where interoperability and standardization could be fostered." Cloud services in all sectors are expected to generate revenues of about €35 billion (US$50 billion) in Europe by 2014, according to IDG News Service.

Cloud computing has also taken firm root in the Asia Pacific region. According to a Frost & Sullivan report (May 2011), 21 percent of respondents to a regional survey have adopted clouds in one form or another. China is building a city-sized cloud computing and office complex that will include a "mega" data center. India is looking to extend and improve the nation's education system by moving critical applications such as virtual learning environment (VLE), learning management system (LMS), and student information system (SIS) implementations into an education cloud.

Case Study: Regional Government in Spain

The **Regional Government of Castilla-La Mancha, Spain**, provides administration, education, and health services for 919 municipalities. It employs 12,000 administrators, 30,000 educators, and 30,000 healthcare workers. Much of the population served is dispersed in small towns and rural areas. Castilla-La Mancha developed a cloud strategy to accelerate the rollout of e-government applications for pensions, taxes, and drivers' licenses, and to support an education

portal providing online learning and virtual classrooms. The cloud will also enable a virtual classroom environment that allows teachers and students to use, share, and upload instructional content regardless of physical location. The cloud implementation–a Vblock 1 platform that integrates a Cisco Unified Computing System™ (Cisco UCS™) with EMC storage and a VMware hypervisor–enabled Castilla-La Mancha to reduce the number of physical data centers from 48 to 2 and to automate workloads. Potential savings: about €400,000 (US$550,000). For more information, see the video.

Spotlight on Cloud Computing Benefits

Many of the benefits derived from cloud computing are comparable to the advantages that businesses and individuals experience when they make use of community utilities like power, water, and public transport. Sometimes it simply makes more sense to consolidate ICT assets than to purchase and develop them for use in separate sites or to set them up as separate systems.

Public sector organizations throughout the world look at cloud computing as the natural next step in their shared services approach. Government entities are already accustomed to sharing data and resources, so they are well positioned to take full advantage of cloud infrastructures.

In education, schools, colleges, and universities around the world are rolling out wireless networks that increase student access to a broad array of instructional resources. These organizations are also upgrading their data centers to take advantage of virtualization for critical applications used by faculty, students, administrators, and researchers. An increasing reliance on bandwidth-intensive video for teaching and learning has put pressure on CIOs at educational institutions to adopt cloud computing for student email access, learning management systems, and storage, as well as virtualized collaborative technologies.

In the healthcare arena, cloud computing not only offers operational and cost efficiencies, but also has the potential to connect medical devices and store a diverse mass of medical data for easier retrieval. The cloud can collect data, analyze trends, and even create alerts for physicians. Cloud implementations can also be used for advanced delivery methods, such as medicine-at-a-distance applications that provide patients in rural areas with access to a level of care normally available only in urban centers. For smaller hospitals, clinics, and medical practices, cloud services lift the burden of hiring internal IT staff to maintain in-house infrastructure. In addition, cloud deployments give large provider networks the ability to strengthen relationships with referring physicians and patients.

Cloud services provide all these organizations with convenient, on-demand access to a common pool of configurable computing resources: networks, servers, security, storage, applications, and services. With a cloud implementation, an organization can tap the compute power available over the Internet, reaping the advantages of data center consolidation and shared public and private resources. Moreover, users can access virtualized, productivity-boosting services that were previously unavailable to them.

In fact, virtualization is currently a major driver of cloud deployment across all sectors. Clouds allow even small public sector organizations in local communities to innovate in ways that would not be possible were they forced to rely entirely on their own resources. Cities can share resources across a region, and agencies can collaborate across jurisdictions. These entities can move forward to take advantage of cloud technologies in a short period of time, without a large cash outlay.

Furthermore, the public sector in developing countries will be able to adopt advanced applications more quickly and economically using cloud-based infrastructures, in much the same way that phone users in those countries were able to leap directly to new-generation mobile communications and thus avoid the need for an expensive landline infrastructure.

Case Study: IT Department for the State of New Mexico

The New Mexico Department of Information Technology built a private cloud based on a Cisco UCS platform that offers a complete application infrastructure for the state's agencies. "We felt we needed to develop bigger, better, faster, cheaper services than the agencies can develop on their own," according to Michael Martinez, director of the IT department. The cloud implementation supports both internal and citizen-facing applications, which can now be rolled out in less than a day. By consolidating operations on virtualized platforms, the state saves money, space, and energy. In addition, the IT team created a revenue stream by charging back for the services, giving them more budget for keeping their technology up to date. In essence, they have become a leading-edge service provider within the government. For more information, see the video.

Cost Reduction and Control

The public sector is under intense pressure to cut costs without undercutting critical services. Cloud computing can reduce total cost of ownership (TCO) both directly and indirectly.

Facilities consolidation: Many organizations are attracted to cloud computing by the savings that come from consolidating their data centers. Resources that can be pooled include storage, compute, memory, and network bandwidth. In addition, because cloud services are largely location-independent, organizations can save on real estate and energy costs–and reduce their carbon footprint at the same time.

Labor optimization: Because a cloud deployment does not require as much provisioning, software development, or maintenance as a conventional infrastructure, organizations can make better use of valuable ICT expertise by redirecting the workforce from routine operational and maintenance duties to mission-critical tasks.

Asset utilization: Many of today's public sector data centers are characterized by relatively poor asset utilization (often as low as 25 percent). There is also considerable duplication of equipment and effort across agencies and departments. When they can share applications, storage, and compute power, organizations do not have to build for peak usage that rarely occurs. Furthermore, they do not have to rely solely on the resources they own.

Capital expenditure (CapEx) reduction: Cloud computing represents a pay-as-you go approach to ICT, rather than an incremental capital expenditure approach. Initial expenditures are comparatively low. Operating expenses go up or down depending on usage, so cash flow matches TCO. Additional investments are made only when they are needed.

Measured services: A cloud implementation can automatically control and optimize resources by metering services. This makes it easier for managers to track expenses, establish charge-backs, and integrate cost controls into their future plans. Multiple payment models are possible, including pay for use, subscription, and fixed plans.

Improved Agility and Adaptability

As the pace of technology quickens, ICT specialists are looking for network solutions that enable them to react quickly, innovate smoothly and efficiently, and keep growing pains to a minimum. Cloud computing can often make change less burdensome and expensive.

Virtualized resources: Virtualization may add a new level of complexity, but the benefits include improved agility and additional options for future enhancements. For example, as workforces become increasingly mobile, virtualized desktops allow them to do their work anywhere, on a variety of personal devices. Virtual machines are not tied to particular servers, so they can migrate among physical devices and across geographies.

Simple scalability: With bandwidth-hungry applications proliferating, the network's traffic keeps increasing, even if the number of users stays the same. With a cloud platform, managers can add capacity on demand without having to determine requirements beforehand or go through many of the traditional procurement, provisioning, and implementation processes. Load fluctuations are less of a problem when capacity can be added almost instantly. Of course, ICT groups still need to maintain robust network infrastructures regardless of which cloud models they implement.

Elastic services: The cloud approach makes it easier for organizations to expand or contract services quickly by tapping into shared pools of resources or implementing prepackaged capabilities developed by third parties specifically for clouds. Furthermore, private cloud deployments using multitenant servers mitigate the "server sprawl" that often accompanies growth.

Fast deployment: With software vendors increasingly delivering their products preinstalled in virtual machines, much of the traditional installation and configuration work associated with software deployment may not be necessary for a cloud implementation.

Increased flexibility: The variety of cloud deployment and service models ensures that implementations can be aligned closely with business needs and ICT strategies. Many public sector organizations are choosing a hybrid cloud approach that lets them benefit from both private and public clouds.

Case Study: MDI, Healthcare Informatics

MDI is a market leader in healthcare administration, data warehousing, and analytics, serving 31 U.S. states and Puerto Rico. Built on Cisco UCS, VMware, and NetApp technology for maximum availability and extensibility, the MDI cloud infrastructure supports a software-as-a-service (SaaS) business that gives clients web-based access to analytical tools. The up-down scalability and efficient footprint of the system enables MDI to deliver their solutions in multiple ways, including as a hosted private cloud at client sites. Provisioning new server and storage resources now takes just hours. The company can manage all the resources as a single,

redundant, uniform pool that can be configured on demand. "We can respond to client requests in days versus the 6 to 12 months that a competitor might need," says Billy Steeghs, senior vice president of IT. "We're able to sprint while other companies are still walking." For more information, download the success story.

Better Services and Collaboration

Government at all levels is looking for ways to improve services and justify budgets, while public education and healthcare organizations are constantly striving to make instruction and medical delivery more available and effective. These organizations are turning to cloud computing as the foundation for optimizing current and future services.

Application proliferation: Cloud computing supports applications that offer new and better ways for government to engage with citizens. For instance, the nationwide cloud infrastructure proposed for the United Kingdom will feature a government application store that functions as an online marketplace for effective business solutions, encouraging the sharing and reuse of online services across the public sector. Since late 2009, the U.S. General Service Administration has offered an online storefront for cloud solutions called Apps.gov. Japan's Ministry of Internal Affairs and Communications is building a cloud computing infrastructure to consolidate all government ICT systems. Tentatively called the Kasumigaseki Cloud, it is in part designed to launch new, advanced applications in a timely manner.

Broad reach: Governments can use cloud platforms to provide access to a wide range of services from a single community portal at any time of day, so that citizens do not have to visit a government office in person during business hours. Educational institutions can use cloud technology for applications ranging from distance learning and curriculum deployment to professional development and greater access to research and researchers. And healthcare organizations can employ clouds to reach out to patients in underserved communities, make records more readily available, and connect dispersed offices and laboratories.

Closer interaction: Cloud-enabled collaboration technologies allow public employees to interact with their peers more efficiently. They also foster interagency cooperation, bringing related organizations into closer contact so they can serve their constituents better and respond faster to emergencies. Additionally, agencies engaging in public-private partnerships can take advantage of collaboration applications to strengthen their ties to companies, private institutions, nongovernment or civil society organizations, and other stakeholders.

Case Study: Cisco Networking Academy

Cisco Networking Academy® is a global educational program that partners with institutions and communities to teach 1 million concurrent students each year how to design, build, troubleshoot, and secure computer networks. In addition to teaching cloud computing in some of its courses, the Networking Academy makes use of cloud-based curricula and instructional tools. For example, because the program is local in its focus, teacher professional development is particularly important to success. Networking Academy employs Cisco WebEx® teleconferencing technology to deliver training opportunities and engage classroom teachers in over 165 countries. The program also creates and supports web-based communities that allow teachers to share and learn from each other. For more on Cisco Networking Academy, visit the website.

Effective Risk Mitigation

Despite some misgivings on the part of CIOs and other ICT professionals (see the Cisco white paper Cloud Computing Concerns in the Public Sector), cloud computing is not necessarily riskier than conventional computing models. Proven methods and technologies are in place to help ensure that systems run reliably, and that data and privacy are safeguarded.

Assured service levels: With the right mix of cloud deployment models, managers can make sure that existing service-level agreements (SLAs) are maintained. In fact, cloud service providers can sometimes offer a higher level of service than some ICT groups can provide when they are constrained by limited resources.

Robust resilience: Automated recovery can actually be easier to implement in a cloud environment because resources are more consolidated. Many organizations use their private cloud as a failover for a public cloud to increase resilience. In some cases, service providers may be able to respond to outages more quickly than internal ICT personnel.

Strong security: In general, data in a cloud environment can be secured with as much confidence as can data in a closed enterprise network, provided the system is equipped with appropriate protective measures and is well maintained. Public organizations that have particularly strict security requirements may opt for a hybrid or private cloud implementation that provides more protection than a public cloud. And policy-based technologies such as role-based authentication are offering ICT managers powerful new options for safeguarding resources.

Case Study: Chinese University of Hong Kong

In the past, individual departments at the 14,300-student Chinese University of Hong Kong (CUHK) purchased their own network hardware, servers, and computers, which increased complexity and created compatibility problems. Recently university administrators found that they needed more computing power, especially for medical and scientific research projects. CUHK's ICT group responded to the challenge by centralizing and virtualizing all the data center and network resources on a private cloud platform based on Cisco Data Center Business Advantage Architecture and VMware. This cloud approach has reduced energy consumption, cooling costs, rack space requirements, and cabling. It has increased operational efficiency. And the ICT team found that it is much easier to manage the budget now that ICT costs are charged back to departments on a monthly basis. For more information, download the case study.

Drivers for Cloud Computing

In October and November of 2010, IDG Enterprise conducted a survey of more than 1500 professionals involved in purchasing ICT products and services. They represented large organizations that average more than 15,000 employees. About 11 percent of respondents worked for government or nonprofit organizations, and 9 percent were involved in education. Of the professionals surveyed, 59 percent expected their budget for cloud technologies to increase in the coming year.

Table 2 summarizes the drivers that the survey respondents rated as "very important" or "somewhat important" when considering an investment in cloud computing.

Table 2. Top Drivers for Cloud Computing

Driver	Percent of Respondents
Enable business continuity	79
Greater flexibility	77
Improve customer support or services	76
Reduce resource waste	75
Enable innovation	70
Need for real-time information	65
Gain a competitive edge	65
Expand revenue opportunities	63
Savings on CAPEX	61

Source: *IDG Enterprise*

Of the non-ICT respondents, 61 percent said that cloud computing is playing a role in shaping their organization's overall business strategy, and 28 percent said that the cloud is playing a critical role. Not surprisingly, the survey found that a large majority of the organizations involve their ICT groups in final cloud purchases; a minority (41 percent) actually require ICT involvement. In fact, a range of individuals and groups often participate in the cloud adoption process, including upper-level management.

In addition, the survey revealed that only 33 percent of the respondents were "very confident" that their current network was ready for cloud computing, while 41 percent were "somewhat confident." This suggests that many organizations have some work to do before they feel confident that their infrastructures are cloud-ready.

Planning for Cloud Deployments: Some Fundamental Questions

Each organization needs to plan its own path to cloud computing. That process may include answering fundamental questions such as:

- How often does our organization need to change?
- What new operational models do we need to implement?
- What constraints are keeping us from fully utilizing the current infrastructure?
- What are the benefits and limitations of clouds for our process?
- What is the expected impact on our costs and budget?
- What aspects of the organization's budgeting and procurement process will need to change?
- Which regulations and compliance requirements do we need to meet?
- What is our tolerance for risk?
- How should we accommodate the legacy ICT infrastructure?
- Which applications should move to a cloud?
- How much technology independence do we require?
- How much control do we want to retain over the infrastructure?
- What aspects of our organization's culture will need to change?
- How can our operations become more environmentally friendly?
- How does cloud computing fit into our overall strategy and future goals?

Conclusion

For a significant number of ICT decision makers today, cloud computing is a catalyst, if not a prerequisite, for innovation and transformation. The cloud approach is an important component in many e-governance, education, and healthcare strategies worldwide.

Cloud computing can greatly benefit public sector organizations of all types and sizes by:

- **Reducing costs and controlling costs:** Consolidate facilities, optimize human capital, utilize assets efficiently, reduce CapEx, meter and charge for services
- **Improving agility and adaptability:** Virtualize resources, increase capacity with simple scalability, expand or contract services to meet demand, deploy software quickly, expand flexibly to meet needs
- **Enhancing services and collaboration:** Take advantage of leading-edge applications, provide broad access for stakeholders, improve collaboration
- **Addressing risk issues:** Maintain critical service levels, help ensure resilience, choose cloud computing options that meet security and privacy requirements

According to survey results, top drivers for cloud computing implementations include business continuity, flexibility, better customer service, waste reduction, innovation, and the need for real-time information. The impetus for adopting a cloud approach comes from all parts of public sector organizations, but there is some concern about network readiness.

By selecting their cloud models wisely and aligning them closely with their organization's business model, public sector ICT decision makers can deploy an effective, economical solution, while also successfully addressing reliability, data management, and security issues.

For More Information

To find out more about cloud computing and how Cisco helps public sector organizations find their cloud advantage, visit:

- www.cisco.com/go/govcloud
- www.cisco.com/go/education
- www.cisco.com/go/healthcare

Appendix: Cloud Service Model Definitions

Cloud service models include:

- **Software as a service (SaaS):** The service provider makes applications available on a cloud platform, and the applications are accessible to users from various client devices using a web browser. The service provider manages the underlying cloud infrastructure, including network capabilities, servers, operating systems, and storage. Customer organizations may have their own application configuration settings. Business process as a service (BPaaS) is a subset of this model.
- **Platform as a service (PaaS):** The service provider delivers a computing platform and solution stack to customer organizations on a cloud, enabling them to deploy applications without the need to control or manage the underlying hardware and software infrastructure themselves. The customer retains control of the applications. PaaS offerings may include facilities for application design, application development, testing, deployment, and hosting, as well as application development services.
- **Infrastructure as a service (IaaS):** The service provider enables the customer organization to provision processing, storage, networks, and other fundamental resources on the cloud, and to deploy and run designated software. The customer does not manage or control the underlying cloud infrastructure, but does have control over operating systems, applications, storage, and certain other components such as host firewalls.

For formal NIST cloud computing definitions, see The NIST Definition of Cloud Computing.

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