

Cloud Computing Can Close the Development Gap

By Kenneth I. Juster^{*}

Despite tremendous global economic growth over the last few decades, prosperity has evaded huge swaths of the world. Hundreds of millions of people still live in abject poverty with limited prospects for social and economic development. It was in recognition of this imbalance that the United Nations adopted the Millennium Development Goals (MDGs) at the U.N. Millennium Summit in 2000. However, more than midway through the 15-year time frame set to realize the MDGs, progress against the goals – whether reducing extreme poverty, providing universal primary education, or advancing the quality of healthcare – continues to be uneven at best. The substantial gap between aspiration and reality was underscored at the recent session of the United Nations General Assembly in New York in September 2008. The current financial meltdown and the worldwide economic recession will only exacerbate this situation, as there will be even fewer resources available to close the development gap.

“Cloud computing” – a paradigm shift now occurring in the information technology (IT) industry – offers the strong possibility of accelerating social and economic development, even in this time of limited resources. Historically, development agencies and non-governmental organizations (NGOs), especially in developing countries, have not been able to fully leverage information technology to further their goals and

^{*} Kenneth I. Juster is Executive Vice President of salesforce.com and former U.S. Under Secretary of Commerce.

objectives, primarily owing to the significant cost and complexities in deploying and managing IT. Now, as the information technology industry goes through a major shift, founded on the Internet as a platform, new opportunities are open for them to employ technology at a lower cost and with much greater ease and success than in the past. While ubiquitous and affordable Internet access – as well as reliable electricity – is not yet a reality today, there are sufficient pockets of the developing world that are equipped to take advantage of this new approach to delivering and consuming IT. Governments around the world should actively promote policies and partner with the private sector to accelerate the availability of Internet access to all citizens, and ensure that the new information technology model known as cloud computing is not hampered – intentionally or unintentionally – by the evolving regulatory environment around the Internet.

The Rise of Cloud Computing

The information technology revolution lies at the heart of global economic growth over the last several decades. From the 1970s to the 1990s, productivity grew threefold in sectors that invested heavily in IT compared with those that did not.¹ Today, IT has become a strategic asset for companies, increasing competitiveness and shaping business operations from finance and logistics to customer relations and human resources.

However, the direct and indirect costs of IT deployments have been substantial. This is because IT systems have traditionally been run on an “ownership” model, requiring investment in all the underlying infrastructure, ongoing maintenance of systems, and, every few years, expensive and time-consuming upgrades. This model of deploying IT has been riddled with high costs, long implementation timelines, project overruns, and

a high risk of failure. It is estimated that about 50 percent of IT projects routinely miss deadlines and run significantly overbudget, about 20 percent of such projects fail altogether, and only 30 percent finish on time and on budget.²

The new millennium, however, has witnessed a major shift in the information technology industry. The Internet has opened the door for a new, “utility” model of information technology. Instead of having to buy and set up IT systems – the servers, the storage devices, the networking, the software, the databases – users can tap into IT capabilities and solutions over the Internet, regardless of where they are located in the world, simply by going to a Web site and logging in. The actual computing – the processing and storage of data – does not take place on an individual’s computer or within a company’s own IT facilities. Rather, the computing is done remotely, often thousands of miles away, in large data centers that process and hold data for thousands of companies or millions of users. This shift in how IT is delivered and consumed is analogous to the evolution in electricity a century ago, when businesses began purchasing electricity as a service from power utilities, rather than owning and running their own power generators.

This new information technology model is called “cloud computing,” because it involves simply tapping into computing power over the Internet – that is, over the “cloud.” The benefit of this new model is that it creates enormous economies of scale, substantially lowering the cost of IT. And it eliminates the technical complexities and the long deployment cycles of planning, installing, maintaining, and upgrading IT systems.

Cloud computing was first pioneered in the consumer world by companies such as Google, Yahoo!, and Amazon.com. More recently, Web sites such as Facebook,

MySpace, YouTube, Wikipedia, and Twitter have given rise to the phenomenon of social networking, communities, and user-generated content. No technical skill or expertise is required to use these services. They are easy to personalize, and in fact, they are so easy and painless to use that consumers do not even think of what they are doing as “computing.”

Given the tremendous ease and power that cloud computing provides, it is no surprise that this model is catching on in the business world. Companies are using Web-based services to manage operations as diverse as finance, logistics, customer relations, and human resources. The software for these services resides in remote, data centers rather than on each employee’s computer or on company servers. Recently, companies have also started using Facebook-like social networks on the Web for their customers, business partners, and employees. In addition, companies are changing the way in which they buy and utilize hardware and IT equipment. Instead of purchasing or leasing racks of servers or data storage equipment, companies can now buy computing power – server and storage capacity – as a service that can be used over the Internet. In this way, a company would pay only for the amount of capacity it uses, and could expand or shrink usage, on the fly, as its needs change. Of course, under this “utility” model, companies need to be comfortable with the notion that their data will not reside within their own four walls but on remote infrastructure shared with others. The reality, however, is that these mega data centers generally have more sophisticated, state-of-the-art security, disaster recovery, and service reliability capabilities than virtually any individual company is able to deploy in its own computer operations.

Cloud Computing for Development

The traditional, “ownership” model of technology has presented significant obstacles for development agencies and NGOs to consistently and broadly exploit IT. Not only are the barriers to entry very high, but the resources required over time to sustain such technology deployments are often prohibitive. The technology industry has played a critical role in trying to alleviate some of these issues. Companies such as Cisco, HP, IBM, Intel, Microsoft, and others have a strong record of supporting social and economic development initiatives around the world as part of their corporate philanthropic efforts. They have made substantial contributions over the years in the form of donations of equipment and infrastructure, as well as strategic engagement on development projects to offer direction, advice, and expertise. Nevertheless, the complexity of IT deployments, the expertise required to maintain IT systems over the course of their lives, and the resources required to support IT users, have often rendered the use of information technology outside the reach of development organizations, and prevented IT from being used pervasively, particularly in developing countries.

As with consumers and businesses, cloud computing holds tremendous promise for development organizations, including agencies and NGOs in developing countries. Development organizations already use the Internet in various ways. In the early days of the Internet, for example, many development agencies and NGOs were quick to set up Web sites to broadcast their message and reach out to a wider audience. Today, of course, having a Web site is as common as printing a brochure, and development organizations use Web sites to provide detailed information on their activities and programs.

The Internet is also increasingly being used as a means to engage in trading and commerce to advance the economic prospects of rural communities. A case in point is an initiative in India called e-choupal, which provides vital information on crop prices, weather conditions, and scientific farming practices to 3.5 million farmers across 31,000 villages, and allows them to use an e-trading service to get the best prices in selling their crops over the Internet.³ More recently, the Internet has been used as a communication channel to deliver higher-quality social services to people in rural areas. Telemedicine, which allows people to connect over the Internet to receive medical advice from specialists thousands of miles away, is one such example.

Although the Internet is currently being used in these ways to further social and economic development, such efforts are still largely rooted in the “ownership” model of information technology – albeit with the Internet as the communication network to transfer data. Cloud computing now enables development organizations to greatly expand their capabilities by deploying sophisticated information technology solutions without the cost and complexities of purchasing and setting up IT systems. In the same way that companies are now using Web-based services to manage their business operations, development organizations have the opportunity to improve the efficiency of their internal operations using software solutions offered as a service over the Internet. In addition to using pre-built software over the Internet, development agencies and NGOs can use online services to build customized Web-based software programs for their own specialized needs – ranging from fund-raising and grant management to volunteer programs and project management – with little coding or technical resources, similar to the way individuals create personalized Web pages on Google and Yahoo! with point-

and-click ease. Using software in this manner allows development organizations with limited resources to benefit from regular software updates and innovations without additional expense or disruption to operations.

Beyond improving internal operations, cloud computing can be employed to promote development initiatives and achieve higher levels of social and economic progress in disadvantaged communities. Just as mobile phones enabled communities with no access to landline phones to become connected to the rest of the world, cloud computing can enable disadvantaged communities to leapfrog into the next generation of information technology. In order to fully exploit the benefits of this new IT model, the development sector will need to invest in training local stakeholders with the skills and expertise needed to take advantage of this new IT model, which will also have a positive impact on the broader knowledge base in developing countries. Taking cues from successes with consumers and businesses, it is possible to contemplate how cloud computing could be exploited to make a difference in the development context.

Healthcare. Advancing the quality of healthcare is a key development objective. In fact, three of the eight MDGs adopted by the United Nations pertain to healthcare – combating HIV/AIDS, malaria, and other diseases; improving maternal health; and reducing child mortality.

In developing countries and rural areas, a high percentage of healthcare complications and fatalities arise out of medical errors, misdiagnoses, and the lack of basic knowledge and expertise. One objective of healthcare NGOs in developing countries is to improve the level of expertise among medical professionals serving these communities. However, despite the best of intentions from all sides, a practical challenge

that these organizations face is the difficulty of brokering exchanges and communications among interested parties – those looking for assistance and those willing to provide it.

While it is common practice for doctors in developing countries and rural areas to refer to health information Web sites, these doctors also require a knowledge-sharing service in order to tap into the expertise of their peers and top medical professionals from around the world. This would take the current practice of telemedicine to the next level, creating a network that goes beyond the one-to-one, patient-to-doctor or doctor-to-doctor interactions. The Internet, as an open, global communications network, provides a mechanism to facilitate such exchanges. But that is not sufficient without the necessary IT solutions and systems – such as a database of experts categorized by medical specialty, a communication forum to post inquiries and address questions to specific experts, and a searchable repository of previous inquiries.

These are not trivial tools or solutions to develop. However, with cloud computing services, a development agency can put together all the pieces necessary to get a system of this nature up and running in relatively short order and with a relatively modest upfront investment. In this way, a medical professional in a village in Bangladesh, who may have a patient suffering from an infectious wound, could instantly correspond – possibly on a mobile device – with other doctors within the region and outside who may have more experience with such a case.

Another challenge in the healthcare sphere in rural areas is ongoing patient care. With few clinics and limited medical staff, healthcare providers often lack the means to supervise treatments and monitor patient progress. This was, for example, a major roadblock when the South African government formulated a policy in 2004 to administer

antiretroviral drugs to all HIV patients who had developed AIDS. Implementing this policy required health authorities to be able to track drug regimens and monitor the effect of the drugs on each patient. In order to do this, the International Development Research Centre (IDRC), in partnership with local South African organizations, funded the deployment of an information technology system. Using this system, staff in clinics can now enter patient data on computers or hand-held devices. These electronic medical records are sent daily to a central location where patients are monitored for resistance to the drugs. The system, which also gives clinicians reminders for patient care, has played a key role in the South African government's AIDS program.⁴

Similar IT systems serving the purpose of managing ongoing patient care would be tremendously valuable in rural clinics around the developing world. But most such clinics do not have the resources or funding to build, maintain, and manage IT systems. With cloud computing, it is possible to have patient care systems – similar to the one funded by IDRC in South Africa – implemented widely, but without requiring clinics to buy and manage all the hardware and software. Incorporating such solutions into the operations of clinics is one way in which healthcare NGOs can advance the quality of patient care in rural communities.

Microfinance. Development organizations have recognized that an effective way to address extreme poverty – another one of the MDGs adopted by the United Nations – is through injecting a business mindset into local communities. Thus, over the last decade, microfinance has proven to be a great catalyst for small-business entrepreneurs in developing countries. Despite the buzz around microfinance, the reality is that there are significant challenges in scaling this financing model. Given the very nature of lending

“micro” amounts, the cost per loan is often too high for this model to scale broadly. The process of screening potential clients and processing loans is a cumbersome task.

Moreover, it is difficult for microfinance institutions to follow consistent standards in granting loans, which has a direct impact on the ultimate success of their programs. And once loans are made, microfinance institutions have a hard time managing their portfolio of loans – tracking collections, monitoring overdue accounts, and making sure loans are used appropriately. Though microfinance works largely on personal connections and relationships in local communities, loan officers still need a way to administer their operations and report back to their sponsors, such as NGOs, credit unions, or financial institutions.

Currently, the technology employed by many microfinance institutions, especially smaller ones, is limited primarily to using spreadsheet programs. As a general rule, these institutions do not have the resources to deploy sophisticated IT systems similar to those employed by commercial lenders, yet they have to manage complex operations. Again, cloud computing can enable microfinance institutions to utilize easy-to-deploy IT solutions that create efficiencies and lend transparency to their financial management and performance. Imagine, for example, if a loan officer at a small microfinance agency in Africa could simply go to the Internet and log into a Web site to screen loan applications, manage existing loans, and track collections. And imagine if the executive director or sponsor of the microfinance agency could go to the same Web site and log into his or her own account to view the agency’s aggregate loan performance as well as the performance of each region, office, or loan officer. A few microfinance institutions in Ecuador, Nicaragua, Honduras, and India have begun to experiment with some of these IT

concepts into their day-to-day operations. Though microfinancing is largely a private undertaking not controlled by any one organization, it would be in the interest of microfinancing associations and development agencies to build and promote IT solutions – based on cloud computing – that could be adopted more broadly in the microfinance world. Using these solutions, microfinance agencies will be better equipped to scale and help alleviate extreme poverty in more parts of the world.

Disaster recovery. While disaster recovery is not directly a development objective or one of the United Nation’s MDGs, the increased incidence of hurricanes, earthquakes, wildfires, floods, and other disasters is displacing communities and causing tremendous damage throughout the world. Hurricane Katrina in the United States was a reminder that no community – including those in wealthy nations with substantial resources at their disposal to manage emergencies – is immune to the logistical nightmare of major evacuation and recovery operations. Information technology can serve as a critical tool in evacuation and recovery operations, but there is little luxury of time to develop and deploy systems.

Given its turnkey nature, cloud computing can make a significant difference in mobilizing resources in emergencies. In fact, when the official response to Hurricane Katrina was deemed sorely insufficient, a number of grass-roots and community-organized initiatives sprang up. These efforts were able to leverage the power of Web-based services to get up and running quickly and with minimal resources. One such initiative was the creation of an online database – running entirely on shared infrastructure – for evacuee and survivor tracking.⁵ This effort enabled families and friends, dispersed across many cities and states, to identify and locate one another, or to

provide clues that could help in locating missing victims. Another initiative, named the Broadmoor Project, set up a database of over 2,400 homes located in the Broadmoor section of New Orleans. The purpose of this initiative was to match available resources and volunteers to houses that needed repairs. Using this service, the Broadmoor community was able to effectively tap into the thousands of volunteers who came to New Orleans with a commitment to rebuilding the city.⁶

These initiatives were extremely effective. However, what were scattered, grass-roots efforts during Hurricane Katrina should become a regular and routine part of evacuation and disaster recovery operations – not just in the United States, but when natural disasters hit poor countries. A number of NGOs involved in disaster recovery, including the Red Cross and the United Nations World Food Programme, are already piloting IT solutions running on cloud computing infrastructure to help with mission critical activities such as procurement and distribution of food and supplies during natural disasters. As emergency management agencies and NGOs work together to build a best-practices blueprint for managing disasters, they should standardize on such solutions that can be deployed instantaneously when disasters occur.

Policy Implications

To fulfill the potential of cloud computing in all spheres of social and economic activity – including in advancing development objectives – it is important that the emerging international regulatory environment be compatible with this new technology. Whenever there are new ways of doing business, new policy issues invariably arise. For example, in the early days of the Internet, 10 to 15 years ago, there was no regulation,

and people likened it to the Wild West. Over time, there have been calls for greater regulation of the Internet to protect consumers and businesses. While some regulation is certainly required in several policy areas, such regulation should be carefully considered to ensure that it does not become either a tool for protectionism or a roadblock to innovation and progress.

At the most basic level, the obvious prerequisite for taking advantage of cloud computing is access to the Internet. In developing countries and hard-to-reach rural areas, Internet access cannot be taken for granted. Most of the world's Internet traffic flows through undersea and underground cables. Given the infrastructural challenges and prohibitive cost of providing such "wired" Internet connectivity in remote areas, telecommunications companies have been reluctant to extend these networks to poor, sparsely populated areas of the world. Today, over 90 percent of the world's estimated 1.5 billion Internet users reside in the developed world. Internet usage, though growing rapidly in developing countries, is still at a low level. Only about 15 percent of the aggregate population in developing countries has some form of access to the Internet.⁷

Governments can play a critical role in pushing and adopting policies that ensure that Internet access is ubiquitous and affordable – including setting policies and partnering with the private sector to determine the best available alternatives to extend Internet access into remote areas. Currently, there are a number of initiatives underway to explore alternatives to "wired" Internet access, including Wi-Fi, WiMax, satellite-based Internet connectivity, and the utilization of unlicensed airwaves or spectrum known as "white spaces." Indeed, the World Bank, the United Nations, and independent bodies such as the Wireless Internet Institute are working jointly with governments and with

technology companies to accelerate the delivery of inexpensive wireless Internet connectivity to the most remote and undeveloped parts of the world.⁸ While such efforts are ongoing, mobile phones, which are now used in some remote areas of the world, may provide an alternative means of connecting to the Internet for limited data entry and access to information.

Related to Internet access is the concept of equal access to the Internet for all – an issue known as “network neutrality.” Telecommunications companies that own the physical pipes over which Internet traffic flows argue that they should be able to control and potentially restrict the use of their infrastructure by charging a premium to heavy users who consume significant amounts of network capacity or bandwidth, especially for services such as voice or video. Such tiered pricing has the potential to change the nature of the Internet and undermine the tremendous innovation that the Internet can facilitate, especially in the development sector where organizations would typically not be in a position to pay premiums for network access. As a result, governments need to carefully consider whether any restrictions on Internet access are warranted and, if so, what should be the boundaries around such restrictions so that innovation is not hampered – and the development sector is not effectively penalized and prevented from benefiting from advances in cloud computing.

Data privacy and security is another sensitive issue for lawmakers and regulators. With the increased incidence of misuse of personal data, data theft, and identity fraud, the instinctive reaction within many governments is to clamp down on cross-border flows of data as a way to protect privacy and prevent security breaches. While this may seem to be a reasonable response, it could have serious unintended consequences. A key

underpinning of cloud computing is the free flow of data across organizational boundaries and national borders. Thus, attempts to restrict the flow of information in order to safeguard data could end up having the perverse effect of undermining much of the current innovation in IT and the impact that this innovation can have on social and economic development.

The key issue that lawmakers and regulators should focus on is not where or by whom data are processed and stored, but whether the data are secure and subject to the proper controls. The adoption of industry standards can play an important role in ensuring that appropriate security protocols are followed and in providing transparency into the security operations of cloud computing companies. Given the rapid pace of change in the technology industry and the unique privacy needs of sectors such as healthcare and financial services, governments may want to defer, at least initially, to independent expert bodies to promulgate security standards. Otherwise, there is a risk that, over time, standards that have become outdated will remain embedded in legislation. Governments should focus instead on holding companies to industry standards for privacy and security by regulating the legal consequences and penalties for data breaches that result from failing to meet such standards.

As cloud computing takes shape, the new Internet-based information technology model should be an important lever in accelerating achievement against the United Nation's MDGs, and promoting social and economic development more broadly. Governments, in partnership with the private sector, should seize the opportunity to promote innovation through the utilization of this new approach to delivering and consuming IT. At the same time, governments need to find the right balance in designing

the evolving regulatory framework around the Internet, with the recognition that over-regulation can stifle innovation and the benefits that go with it.

Endnotes

- ¹ Robert D. Atkinson and Andrew S. McKay, “Digital Prosperity: Understanding the Economic Benefits of the Information Technology Revolution,” The Information Technology and Innovation Foundation, page 15, March 2007.
- ² Tim Wilson, “Affordable IT: Staying on Budget,” Network Computing, June 9, 2005, <http://www.networkcomputing.com/showitem.jhtml?docid=1611f4>.
- ³ Kapil Ohri, “E-mpowering Rural India through Internet,” ZeeNews.com, April 15, 2007, <http://www.zeenews.com/articles.asp?aid=365863&archisec=ZNS&archisubsec>.
- ⁴ “IDRC Annual Report 2007-2008,” International Development Research Centre, page 37, 2008.
- ⁵ Dion Hinchcliffe, “Finding the Real Web 2.0,” Social Computing Magazine, November 15, 2005, http://web2.socialcomputingmagazine.com/finding_the_real_web_20.htm.
- ⁶ Larry Abramson, “Database Key in Restoring New Orleans,” NPR, March 11, 2008, <http://www.npr.org/templates/story/story.php?storyId=88112714>.
- ⁷ Nicole Ferraro, “The Internet & the Developing World,” Internet Evolution, January 24, 2008, http://www.internetevolution.com/document.asp?doc_id=143698. Christopher Rhoads, “Start-Up Seeks to Link 3 Billion to Net,” Wall Street Journal, September 9, 2008.
- ⁸ “The Wireless Internet Opportunity for Developing Countries,” Information for Development Program of The World Bank, United Nations ICT Task Force, and Wireless Internet Institute, November 2003.