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**Keynote by Vivek Kundra
Federal Chief Information Officer
“The Economic Gains of Cloud Computing”**

Good morning and thank you for inviting me to speak at the Brookings Institution.

The Obama Administration is changing the way business is done in Washington and bringing a new sense of responsibility to how we manage taxpayer dollars. The President has charged me with tapping into the spirit of American innovation and the power of technology to improve performance and lower the cost of government operations.

Today I'd like to talk about how the government is leveraging cloud computing to deliver results for the American people. The economic gains, the environmental benefits and the ability to provision services on demand are key factors in the government's shift to cloud computing.

There was a time when every household, town, farm or village had its own water well. Today, shared public utilities give us access to clean water by simply turning on the tap. Cloud computing works in much the same way. However, instead of water coming from a tap, users access computing power from a pool of shared resources. Just like the tap in your kitchen, cloud computing services can be turned on or off as needed, and when the tap isn't on, not only can the water be used by someone else, but you aren't paying for resources that you don't use. Cloud computing is a new model for delivering computing resources – such as networks, servers, storage, or software applications.

On September 15, 2009, I announced the Federal Government's Cloud Computing Initiative at NASA's Ames research center, in the heart of Silicon Valley. This region is home to some of the world's most influential and respected high-tech companies, universities and research institutions and is a leading source of technological innovation. It is essential that the government tap into this innovation, and be open to adopting new technologies.

The Federal Government is the world's largest purchaser of information technology. We spend over \$76 billion annually on more than 10,000 systems in support of more than 300 million Americans. Yet our technology infrastructure is fragmented and inefficient. Over the past decade, the number of Federal data centers has grown from 432 to more than 1,100. This growth in redundant infrastructure investments is costly, inefficient, unsustainable and has a significant impact on energy consumption. In 2006, Federal servers and data centers consumed over 6 billion kWh of electricity and without a fundamental shift in how we deploy technology it could exceed 12 billion kWh by 2011. For far too long, the Federal departments and agencies have operated vertically – creating silos that underutilize skilled workers and vital funds, while producing unimpressive results for the American people.

The government must spend less taxpayer money on redundant infrastructure and more time on technologies that improve the lives of the American people. Think about our everyday lives. You can launch your own website in minutes. A small business owner can manage payroll online. A grandmother can share pictures of her grandchildren with family across the world. But why is there such a gap between the public and private sectors when it comes to technology? It wasn't that long ago when Federal employees had better technology at their desks than in their homes.

As the world's largest consumer of information technology and as stewards of taxpayer dollars, the Federal Government has a duty to be a leader in pioneering the use of new technologies that are more efficient and economical.

Many organizations in the private sector are using cloud computing technologies to realize tremendous savings and streamline their operations. For example, NASDAQ is using the cloud to give customers and regulators who ask about past trading actions a snapshot of market conditions at the time of the trade. NASDAQ accomplishes this by slicing and dicing terabytes of historical data in seconds.¹ Starbucks used cloud-based tools to launch an online community in just one month that has generated thousands of ideas from customers and employees on how to improve Starbucks.²

¹ <http://www.wallstreetandtech.com/it-infrastructure/showArticle.jhtml?articleID=212700913>

² http://www.businessweek.com/magazine/content/08_18/b4082059989191.htm

In the government it can take years to procure, configure and deploy technology solutions. By using cloud services, the Federal Government will gain access to powerful technology resources faster and at lower costs. This frees us to focus on mission-critical tasks instead of purchasing, configuring and maintaining redundant infrastructure.

Federal Leadership in Cloud Computing

The Federal Government is made up of hundreds of different agencies that are spread across the world and have diverse technology needs. Our systems and data centers support civil servants and government contractors at all levels – from our President and his cabinet to your local postmaster. We house critically sensitive data that is vital for the protection of our national security and we house public data on websites and platforms created especially for engagement with the American public.

There is no single computing architecture that will meet all of the Federal Government’s needs. One of the most compelling benefits of the cloud is the potential to combine a variety of complementary resources and services to provide a wider range of solutions. To do this, standards for interoperability and data portability in the cloud must emerge.

For example, mobile telephone networks depend on standards and agreed upon protocols so that calls originated on one provider’s network can terminate on another’s. The internet itself relies upon the Internet Protocol to transfer information across a web of different physical networks.

Similarly, cloud customers must be able to easily store, access, and process data across multiple clouds; weave together a mesh of different services to meet their needs; and have a way to collaborate with business partners around the globe. Federated clouds – networks of interoperable clouds that work together – will give rise to service grids which can harmonize technologies, business processes and policies to provide support across multiple businesses, industries, and levels of government. Through such a “network of networks” the true potential of cloud computing will be realized.

This is why National Institute of Standards and Technology (NIST) is charged with leading our efforts on standards for data portability, cloud interoperability, and security.

The standardization of railroad track gauges connected disparate rail systems across the country, exponentially increasing the ease of transporting goods and people by train. Similarly, connecting our many fragmented IT systems will have numerous benefits not just for government but also for private industry and the public. Cloud computing is still in its early stages and many challenges remain. The government does not presume to have a monopoly on the best ideas. When it comes to setting standards for cloud computing, it is our role to initiate the dialogue and engage the best minds across government, industry and academia to participate in the conversation.

To start this process, NIST will host a “Cloud Summit” on May 20, 2010, with government agencies and the private sector. The Summit will introduce NIST efforts to lead the definition of the Federal Government’s requirements for cloud computing, key technical research, and United States standards development. Going forward, we will engage with industry to collaboratively develop standards and solutions for cloud interoperability, data portability, and security.

As we move to the cloud, we must be vigilant in our efforts to ensure the security of government information, protect the privacy of our citizens, and safeguard our national security interests. Federal employees and the American people must be confident that their information is safe in the cloud.

The economic benefits of cloud computing won’t be realized if every agency independently reviews and certifies solutions. The current fragmented certification process – where agencies independently conduct Certifications and Accreditations on the same products – is redundant, and adds both time and cost to an already complex procurement process. For example, over the last six years, the Department of State spent \$133 million amassing a total of 50 shelf feet, or 95 thousand pages, of security documentation for about 150 major information technology systems. We need to shift our focus to real-time security monitoring, rather than generating paperwork.

To address these issues, NIST has created a technical process for centralized certification to provide common security management services to Federal agencies. The process supports the development of common security requirements and performs authorization and continuous monitoring services for government-wide use, enabling Federal agencies to rapidly, securely and cost-effectively procure technologies. Agencies can realize these benefits by leveraging the

security authorizations provided through a joint authorization board. The board consists of the agency sponsoring a system's government-wide authorization and three permanent members: the Department of Defense, the Department of Homeland Security, and the General Services Administration. The board will provide both initial and ongoing acceptance of risk on behalf of the government as systems are continuously monitored throughout their lifecycle.

Agencies across the government have already begun shifting to the cloud. For example, HHS is leveraging cloud computing to support implementation of Electronic Health Records (EHR) systems. To coordinate healthcare providers' implementation of new Electronic Health Record (EHR) systems, HHS is deploying a cloud-based customer relationship and project management solution provided by Salesforce.com. The solution will support HHS's Regional Extension Centers in allocating grant funding to doctors and hospitals for the implementation of EHRs. EHR projects can be individually tracked and analysts will be able to quickly identify best practices for EHR implementation as they emerge.

In addition to HHS, the Department of Interior is migrating 80,000 email boxes to the cloud, NASA recently announced that it is re-evaluating its enterprise data center strategy and has halted future requests for a proposal that would have been up to \$1.5 billion in data center contracts, and the Department of Energy is investing \$32 million on its cloud computing Magellan project.

The Decade Ahead

Cloud computing will drive innovation not just in science and technology, but in every industry and at a pace never before experienced. Just as the Internet has led to the creation of new business models that were unfathomable twenty years ago, cloud computing will disrupt and reshape entire industries in unforeseen ways. To paraphrase Sir Arthur Eddington, the early 20th century physicist whose experiments confirmed Einstein's Theory of General Relativity – It is not only more innovative than we imagine; it is more innovative than we can imagine.

Cloud computing will enable new ideas to come to life overnight by speeding time-to-market. Whereas new businesses were once constrained by physical demands – facing months in procuring, installing and configuring hardware and software – cloud services will enable them to establish operations in days or even minutes. Their efforts can shift to higher-value activities, such as creating new products for their customers rather than installing servers.

Cloud computing will give rise to virtual organizations. Unencumbered by the physical constraints of data centers, hosting providers and hardware platforms, these virtual organizations can focus solely on customer needs, tapping into the near limitless array of options the cloud will provide. In the same way we now create mash-ups to combine and analyze data from disparate websites, new companies will emerge that tie together services from vast networks of suppliers and customers to create a range of new and more agile products and solutions.

As switching costs disappear, organizations will be able to continually shift to new, more innovative solutions as they emerge. Disruptive technologies will be a mouse-click away and vendors will face relentless Darwinian pressure to evolve and improve their products and services in the interest of their customers.

Cloud computing is about the industrialization of services and follows naturally from the combination of cheaper and more powerful processors with faster and more ubiquitous networks. Using the power of the cloud, an entrepreneur with a good idea no longer needs to own a data center to launch a business that serves millions of customers. For example, Animoto, which allows anyone with access to an Internet connection to create their own “MTV”-like videos by uploading audio, photos, and videos to the web, used the cloud to respond rapidly when demand jumped from 25 thousand users to over 250,000 users in three days. Because of the cloud, Animoto was able to scale from 50 to 4,000 virtual machines in three days to support increased demand on a real-time basis.³

Cloud computing offers transformational opportunity to fundamentally reshape how the government operates, engages the public and delivers services. In the next decade, Federal IT is going to go through a massive transformation, freeing CIOs across the government to focus on serving the American people.

Clouds not only connect to people via their various devices, but also billions of sensors that are becoming part of a hybrid Internet – part physical, part virtual. From the electric grid to intelligent transportation systems, hundreds of billions of Internet-enabled sensors will be coming online, and all the information they produce needs to be accessed, analyzed and managed on a real-time basis.

³ <http://blog.rightscale.com/2008/04/23/animoto-facebook-scale-up/>

The essential foundation of cloud computing – the industrialization of services from the cheaper, powerful processors and faster, ubiquitous networks – fundamentally shifts power into the hands of the American people. You will be able to access your home’s electricity usage in real-time to make intelligent choices when it comes to energy consumption. You will be able to access your health records electronically and share them with doctors and providers of your choice. You will be able to create and share performance dashboards that shine light into your government’s performance, as easily as we create and share YouTube videos today.

The Obama Administration is committed to leveraging the power of cloud computing to help close the technology gap and deliver for the American people.

Thank you for your time today. I look forward to your questions.