The Power of Client Plus Cloud Computing to Democratize Research

White Paper
December 2010

For more information, press only:

Mike Houlihan
Waggener Edstrom Worldwide
(503) 443-7000
mhoulihan@waggeneredstrom.com

Whether we realize it or not, nearly all of us as consumers experience client plus cloud technology in our daily lives: when we share photos, shop online, download and use applications for mobile phones, or use a search engine. This seemingly invisible technology has changed how we live and work, empowering us with new kinds of information and services, new ways of communicating and collaborating, and unparalleled convenience.

This technology has the same potential to transform research, but to date it has been relatively underexplored. Cloud computing allows computation to occur in remote datacenters instead of on a user's own computer. With the power of the cloud, the easy-to-use tools that scientists and engineers use every day can become infinitely more powerful than they have in the past — accessing and manipulating more data and applying more complex calculations — while still being used in familiar ways. This ability to provide easy access at arbitrary scale has the power to democratize research by making computing power available for the vast majority of researchers using desktop computers today and by fostering collaborative research communities.

Client plus cloud technology provides an opportunity to empower researchers in new ways, profoundly changing the nature of research and accelerating engineering and scientific discovery around the world.

The Changing Nature of Research

Virtually all research has become data-centric. Over the years, researchers in all disciplines have benefited from improved computer performance. Now, low-cost sensors and instruments are amassing petabytes of data from computer-assisted experiments, simulations and other sources. Scientists and engineers are capturing data at a scale previously unimaginable, and this necessitates a sea change in how they extract insight from all that data.

Research itself is at an inflection point as a result of this explosive data growth, as well as the growing trend of interdisciplinary research. Scientists and academics are required to access and share large data sets and collaborate with other researchers in many disparate locations. For example, accurately understanding and predicting the long-term effects of a major environmental disaster such as an oil spill requires detailed analysis of ocean chemistry, biology and ecology, and the simulation of complex oceanographic and atmospheric models. Today, an expert in one of those areas often works in just that one discipline and only has access to information relevant to that specific area. But to truly address increasingly complex global issues such as climate change, genetics and personalized medicine, researchers will be expected to develop ever-more-complex simulations and models. To do so, they will need to mine, search and analyze huge sets of data in near-real time and collaborate across disciplines like never before. It's their ability to extract insight based upon statistics together with their ability to collaborate that will drive a transformative effect.

Not only are researchers in many fields confronted by an overwhelming amount of data, they also have an insatiable demand for easy-to-use tools and computing support. One of the great challenges created by relatively inexpensive computing infrastructure over the past 15 years is that we've turned generations of researchers into systems administrators. Graduate students, post-doctorates and faculty spend months or years maintaining the computing systems they require to do their research. However, at even the best-funded research organizations, the majority of researchers do not have access to the computing resources they need.

Scientists do not want to spend time building and managing computer infrastructure; they would prefer to focus on their science and leverage easy-to-use technology to advance discovery. Universities and research organizations try to supply the computational support needed, but often lack the necessary scale and funding to keep pace with the exponential explosion of demand. The cost to maintain and refresh this computing infrastructure is becoming a larger and larger burden, and the economics are rapidly becoming unsustainable.

The Client Plus Cloud: A Platform for the Democratization of Research

Fortunately, the emergence of cloud computing coupled with powerful software on "clients," such as a local desktop computer, offers a solution to this conundrum.

Cloud computing can provide software applications and computing power to users as a service over the Internet via familiar tools. The offsite cloud is constantly managed and upgraded, providing the ability to deliver computational resources on demand — a "pay as you go" strategy with access to virtually unlimited computational capacity. The cost to use 10,000 processors for an hour is the same as using 10 processors for 1,000 hours, but will deliver radically faster analysis to the researcher. Organizations can buy just-in-time services to process data and exploit it, rather than on a perpetual refresh of infrastructure that not only increases the capital costs associated with the computing, but also the energy management and security issues, which are increasingly important constraints. Budgets can be invested in the research and in the acquisition of cloud services rather than in the distributed maintenance of infrastructure, allowing researchers to focus on unsolved questions and discovery, not on computing infrastructure. This will be a transformative shift for the majority of researchers who will be able to tap into the advanced computational power that has only been available to a small portion of the researcher community.

Powerful cloud-based data analysis tools will seamlessly connect to and amplify the capabilities of desktop applications that researchers use today, such as extensive spreadsheets, visualization and simulation tools. Data stored in the cloud can be accessible to researchers in many locations from different disciplines who can then build communities around solving complex problems. In Europe, clouds will add a new dimension to the research infrastructure, facilitating the work of researchers using multiple cloud providers and becoming a seamless extension of the highly evolved computational grid.

With cloud computing, virtually any researcher can use simple tools to get answers to complex data-intensive questions. For example, a scientist might use a spreadsheet tool to tap into a genomic analysis service running on 600 servers or use a simple script to do data mining across 10,000 fMRI images in minutes. A researcher could access data from remote instruments such as sensors in a rain forest and pull it down to the desktop for visualization and analysis.

By extending the capabilities of powerful, easy-to-use PC, Web and mobile applications through on-demand cloud services, the capabilities of the entire research community will be broadened significantly, accelerating the pace of engineering and scientific discovery. The net effect will be the democratization of research capabilities that are now available only to the most elite scientists.

Microsoft's Global Cloud Research Engagement Initiative

Microsoft Corp.'s Cloud Research Engagement Initiative is a program intended to start making this a reality in the research communities today. It is a global program involving select academic institutions and government research organizations. The objective of the program is to provide massively scalable tools and services directly to researchers that they can access from their desktops using familiar software tools. Microsoft will work with research organizations to provide free access to advanced client plus cloud computing, the tools to access the cloud, and important cloud services and technical support from Microsoft. The research organizations will identify the programs that will receive the free cloud services and support.

To date, Microsoft has signed agreements with the U.S. National Science Foundation, with Japan's NII Info-Plosion project, with several organizations in Europe—the European Commission's VENUS-C project, France's INRIA and the University of Nottingham in the UK—and with three top organizations in Australia: National ICT Australia (NICTA), The Australian National University (ANU), and the

Commonwealth Scientific and Industrial Research Organisation (CSIRO). The company also plans to announce several more global partnerships in the coming year.

Research in the cloud is a paradigm shift that is just beginning, and Microsoft will continue to make investments in client plus cloud technology globally to continue to drive this positive change.