



# Cloud computing opens up research to the world

*Scientific instruments, environmental sensors, and large-scale simulations are creating more scientific data than ever before. Public scientific data collections are growing rapidly and are becoming central to research collaborations. By using advanced, large-scale information processing facilities, scientists are now able to analyze massive volumes of data in ways that never would have been possible just a few years ago. While a few researchers have access to these large computer systems, most are limited by the processing capacity they can access conveniently and quickly. Cloud computing solutions utilizing Windows Azure allow researchers to access the compute and storage resources that they need, when they need them—without the up-front financial investment required—and help reduce the time between progress and breakthroughs. Windows Azure brings on-demand computing and data access to scientists and researchers everywhere.*

## Harnessing the power of Windows Azure for research

Almost every branch of research has become data driven. Researchers now have access to tremendous volumes of data, which can take days or weeks to process by using the computing and storage resources that are typically available to individuals or small teams. The Windows Azure cloud platform reduces the need to invest in large-scale local compute and storage hardware and simplifies access to shared data collections. Here are four examples of how cloud computing is being used by researchers today.

### **FaST-LMM and Windows Azure put genetics research on faster track**

Today, researchers can collect, store, and analyze tremendous volumes of data; however, technological and storage limitations can severely impede the speed at which they analyze these data. Microsoft Research developed an algorithm to address this issue. The Factored Spectrally Transformed Linear Mixed Models (FaST-LMM) runs on Windows Azure in the cloud and expedites analysis time—reducing processing periods from years to just days or hours. It is compatible with Windows and Linux systems, and has been tested on data sets with more than 120,000 individuals. An early application of FaST-LMM and Windows Azure is helping researchers at the Wellcome Trust in Cambridge, England, analyze data for the genetic causes of seven diseases, including hypertension, rheumatoid arthritis, and diabetes.

### **Aiming to deliver new drugs faster at less cost in the cloud**

It takes massive computing resources to search through chemical and biological databases to find new pharmaceutical candidates. Researchers from Molplex, a small drug discovering company, are working in partnership with Newcastle University and Microsoft Research Connections to reduce the time and cost associated with delivering new medications. Clouds Against Disease is a series of high-quality drug discovery services based on a new molecular discovering platform. It derives its power

from cloud computing with Windows Azure. With this new system, Molplex can access 100 or more Windows Azure nodes to process data rapidly. A drug research team would have to raise millions of dollars before starting a project just to finance the start-up costs. Windows Azure helps eliminate those costs by allowing new companies to pay for only what they use in computing resources in the cloud.

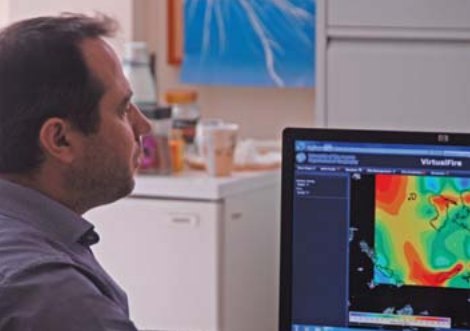
### A window into the future: eco-testing a building before it is even built

The global demand for sustainably designed buildings continues to grow. Unfortunately, many design businesses are unable to meet this demand due to practical implementation challenges, including the time-intensive process of performing computer simulations and the expense of the powerful technology required to reduce execution time. Green Prefab, a small startup



company in Italy, is working with Microsoft Research Connections and the Royal Danish Academy to develop next-generation tools that use Windows Azure to provide inexpensive data-intensive analysis. The Royal Danish Academy used Green Prefab's prototype web-based tools with the supercomputer in Barcelona, Spain, to execute parametric energy simulations of buildings by using the power of cloud computing. The results: the cloud-computing approach achieved a potential energy savings of 33 percent—approximately twice the 17 percent energy savings associated with the traditional method. Running in the cloud also reduced overall computing time. Running the 220,184 parametric simulations on a standard dual-core PC would have taken 122 days using the traditional method. Running those same energy simulations in the cloud took just three days.

### Fire app fights wildfires with data



A weather confluence of high winds, high temperatures, and no rain translates into a high wildfire risk on the Greek island of Lesbos each year. The Geography of Natural Disasters Laboratory at the University of the Aegean in Greece developed the web-based VENUS-C Fire application to help emergency responders better prepare for wildfire season. The app is comprised of Bing Maps, Microsoft Silverlight, and Windows Azure; users can access it through the web by using a standard PC or laptop. The app simulates wildfire behavior on the island based on current conditions. Users can view simulations of existing wildfires or potential outbreaks. The app simulates the predicted behavior of each wildfire, including which way it will spread and at what speed. Emergency responders use this information to adjust their response plans throughout the island.

### Next steps: how to integrate cloud computing into your own research

These projects represent just a small segment of the research work that is being conducted in the cloud. As illustrated by these four examples, integrating the cloud-computing platform into a research project can add new ways to analyze, explore, and share data when compared to traditional methods. There are multiple ways to start exploring how Windows Azure can be applied in your research. These include:

- **Submit a proposal.** Microsoft Research is soliciting proposals for the use of Windows Azure in research. We welcome research proposals from any branch of scholarly activity. Winning proposals will be awarded large allocations of Windows Azure storage and compute resources for one year.
- **Take advantage of academic pricing and entry.** Microsoft offers special pricing for key products, including Windows Azure, to qualified universities.
- **Access Microsoft Research's free tools and resources.** Microsoft Research offers a variety of free tools and resources to help researchers harness the power of cloud computing. These are available on the Microsoft Research site. Windows Azure Linux Virtual Machines preconfigured with powerful open source software are available through the Microsoft Open Technologies VM Depot ([vmdepot.msopentech.com/List/Index](http://vmdepot.msopentech.com/List/Index)).
- **Benefit from free and high quality training and curriculum.** Microsoft Research offers cloud computing training and curriculum resources, authored both by Microsoft and its academic partners.
- **Attend events, panels, and keynotes.** Cloud computing is becoming a popular focus in research workshops and discussions. Look for speakers who will be addressing the topic and make plans to attend.

To find the above information and to learn how to get started using Windows Azure for your research, visit [research.microsoft.com/azure](http://research.microsoft.com/azure). To learn more about Windows Azure, visit [www.windowsazure.com](http://www.windowsazure.com).