In Brief

Every second counts when combating a wildfire. Time lost can result in devastating loss of life or property. The University of the Aegean in Greece developed the VENUS-C Fire app—featuring Bing Maps, Microsoft Silverlight, and Windows Azure—to determine the daily wildfire risk and fire propagation in the vulnerable island of Lesvos during its dry season. The university team generates a visualization of environmental factors each morning for the island's fire management team, who then use the app to determine optimal resource allocation across the island for the day.

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Websites:

research.microsoft.com/
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windowsazure.com
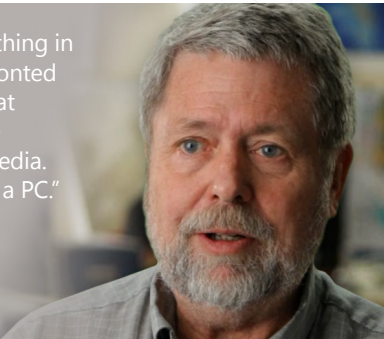
catastrophes.geo.aegean.gr

Fire App Fights Wildfires with Data

Every second counts when combating a wildfire. Time lost can translate into devastating loss of life, property, and natural resources. Firefighters on the Greek island of Lesvos are very familiar with the damage that wildfires can inflict. A weather confluence of high winds, high temperatures, and no rain results in a high wildfire risk on the island each year between May and October. Firefighters in Lesvos may respond to more than 100 fires in those months alone. Technology offers Lesvos firefighters a critical tool in the battle against wildfires: the VENUS-C Fire application running on Windows Azure.

The Fire app is wildfire management software that was designed by the Geography of Natural Disasters Laboratory at the University of the Aegean in Greece to calculate and visualize the risk of wildfire ignition and to simulate fire propagation. The app is used primarily by emergency responders, including the fire service, fire departments, and civil protection agencies that address wildfires on the island of Lesvos.

The app was built with functionality from multiple resources, giving it both technological depth and a visual interface that is accessible to non-technical users. "[The Fire app] nicely integrates Bing Maps, Microsoft Silverlight, and Windows Azure in a single system that allows users to be able to see the big picture of an emerging fire or the potential of an emerging

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fire," observes Dennis Gannon, director of Cloud Research Strategy for Microsoft Research Connections.

All of the Fire app data is stored in the cloud via Windows Azure. "You need a large cloud infrastructure such as Windows Azure to be able to bring these sources together," Gannon explains. "The use of massive data analytics and machine learning is now the new frontier in many areas of science."

To access the tool, all the users need is a regular computer or laptop, an Internet connection, and a web browser that supports Microsoft Silverlight. This has been a tremendous advantage, notes Dr. Kostas Kalabokidis, associate professor, University of the Aegean.

"With the cloud computing infrastructure, we were able to do business as we couldn't do in the past," Kalabokidis states. "[Windows Azure] is essential for us, because the cloud provides us with the necessary processing power and storage that is required. That means the real end users for the fire department do not need to have any huge processing power or storage capabilities locally."

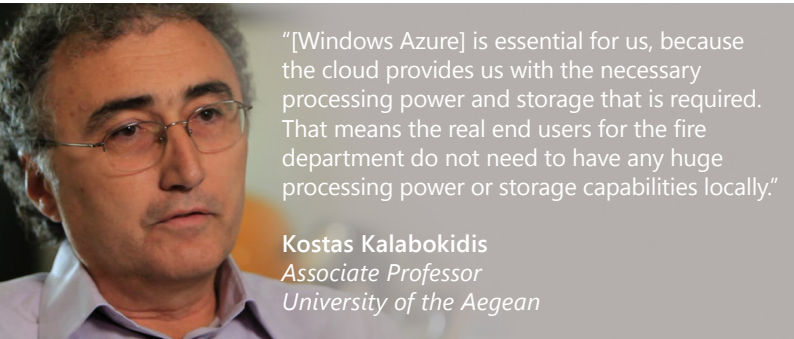The partnership between Microsoft Research and the University
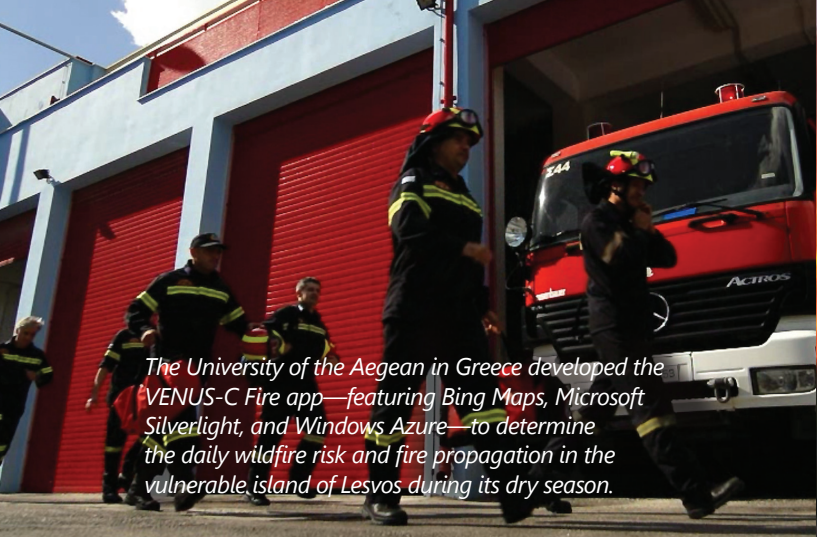
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of the Aegean has existed for a long time, but it was through a European Commission funded collaboration called VENUS-C that the Fire app was built. As part of that collaboration, Microsoft built a tool called the Generic Worker (GW) that greatly simplified the challenges faced by Kalabokidis' team. "Generic Worker provides a robust environment for job execution that fulfilled the requirements of the University of the Aegean's scenario for running forest fire risk and fire propagation models in the cloud," Kalabokidis says. "GW provides interoperability through OGF [Open Grid Forum] Basic Execution Service, which is very important in the Aegean scenario to execute tasks in a hybrid cloud environment, such as VMs [virtual machines] of different cloud solutions.

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Furthermore," he continues, "GW provides scalability: for example, VMs are increased or decreased according to the needs of deployment. Users are also notified about the status of the job, which is important for the execution of the fire propagation simulation."

TRACKING RISK FACTORS DAILY

There are two distinct sets of users accessing Fire app daily during the dry season: the lab team, which loads new information into the tool in the morning; and the fire-response teams, which use the tool to view the data in a refined, graphical view. The process starts with the forecast.

"Every morning, our systems ask the Windows Azure cloud to provide approximately 20 virtual machines in order to process the available weather data," explains Dr. Christos Vasilakos, research associate, University of the Aegean. "It then stores the fire-risk outputs that the user needs to see and make the proper call. From the fire-risk menu, the end user can see for the next 120 hours or five days what will be the fire ignition risk for our study area." Additional information, including an animation of the weather for the next 120 hours, also can be accessed through the same menu.

The information is updated in the morning. At noon, Captain Panagiotis Kypriotellis, officer, Fire Brigade of Greece, accesses the tool. Kypriotellis uses the fire-risk data and fire simulations, together with weather forecast information, to inform the day's resource allocations. Based on the Fire app projections, Kypriotellis may relocate personnel throughout the island. He may also deploy fire trucks to certain areas that appear to be at particular risk that day. The simulator also provides crucial information during fire events, Kypriotellis says.

When a fire is reported, a response team is dispatched to the site. The firefighters who remain at the station use the Fire app to create a wildfire simulation for the blaze. The team begins with the ignition point and pulls in other critical data to determine the fire's potential path.

"We start the simulation with weather conditions to see in the next two hours how far the fire spread will be," states Kypriotellis. The simulation identifies which direction the fire might spread and the speed at which it will potentially travel. The team communicates the simulation information back to the firefighters at the scene and also uses it to determine how best to allocate resources in real time.

FIGHTING FIRE IN THE CLOUD

The Geography of Natural Disasters Laboratory team built the Fire app in 2011 as part of the VENUS-C Project. Earlier, Microsoft Research partnered with the lab during the development phase, providing IT expertise, high-performance computing resources, and cloud computing infrastructure. The advent of cloud computing and storage is having a significant impact throughout the research world, Gannon notes.

"The data tsunami is changing everything in science. Every discipline is now confronted with it—a vast exploration of data that comes from instruments, from online sources, from the web, from social media," observes Gannon. "Analyzing this data can't be done on a PC."

Cloud computing, and the processing power that accompanies it, has made it possible for researchers to reduce processing job times from months to just hours. "The thing that excites me about my job is the possibility that we can change the way science is conducted," Gannon enthuses. "I believe that cloud computing is a revolutionary change in an era of big data."

Kypriotellis believes it has made a difference on the island. While wildfires do still break out, statistical evidence shows the department has been better prepared to respond to and control fires, preventing potential loss of life and property. He is hopeful that, one day, other firefighters will be able to add the tool to their arsenal as well.

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