



# POWERING POSITIVE CHANGE IN LATIN AMERICA

Colombia's High Performance and Scientific Computing Center harnesses the power of supercomputers to advance research and address socio-economic challenges

## Industry

Higher education

## Objective

Advance scientific and industry research, and support socio-economic development in Colombia and other parts of Latin America

## Approach

Develop a supercomputer accelerated by GPUs to power research initiatives

## IT matters

- Provides the computational performance needed to accelerate scientific and industry research
- Enables remote visualization and analysis for research and learning
- Develops software solutions for use by the oil and gas and healthcare industries

## Business matters

- Helps address socio-economic challenges by advancing research in science and healthcare
- Supports economic development through industry research and collaboration
- Gains recognition as a key supercomputing center in Colombia and Latin America
- Enables researchers to produce better academic papers



**The High Performance and Scientific Computing Center at Universidad Industrial de Santander (SC3UIS) is blazing a trail by using supercomputers to support change in Colombia and the rest of Latin America. It has aided the development of Colombia's oil and gas industry and advanced research on cancer, influenza A H1N1, COVID-19, and more, enabling economic growth and helping address social challenges.**

## CHALLENGE

### Addressing pressing problems

High-performance computing (HPC) powers scientific and medical advances, such as finding cures for cancer and more recently, fighting infectious diseases such as COVID-19. And by processing massive amounts of data and allowing simulations, it has made key industries more competitive, enabling economic growth.

But not all countries have the infrastructure and resources to take advantage of this technology. In Latin America, for example, few supercomputers rank among the world's most powerful.

As a systems engineer specializing in supercomputers, Carlos Jaime Barrios Hernández knew how HPC could hugely benefit countries like his native Colombia and other parts of Latin America.

## “Regional collaborations and our ability to use supercomputers are helping push Latin America toward post-pandemic recovery and progress.”

– Carlos Jaime Barrios Hernández, Director, High Performance and Scientific Computing Center at Universidad Industrial de Santander

“When I was doing my PhD in France, I saw how advanced supercomputers, combined with artificial intelligence, could accelerate research and help develop industries,” says Barrios Hernández, now Director of SC3UIS. “So, when I came back to Colombia, I wanted to see how we could build a modern supercomputer for the center.”

SC3UIS provides computing resources to more than 200 students and nearly 100 researchers at Universidad Industrial de Santander (UIS) and to external partners. As part of an academic institution, it’s important for the center to drive excellence in scientific research and help address socio-economic challenges by having advanced supercomputing capabilities.

### SOLUTION

#### Building GPU-accelerated supercomputers

The center partnered with NVIDIA® to become one of the first organizations in Latin America to leverage GPU supercomputing.

“We spoke with NVIDIA architects, and they recommended HPE to integrate NVIDIA GPUs into the center’s platform,” says Barrios Hernández, who is also a professor at UIS.

Together with HPE and NVIDIA, SC3UIS created a cluster called GpUs AdvaNced Environment (GUANE-1) and a few other supercomputers. These platforms have been enabling simulations and machine learning in oil and gas, bioinformatics, and astrophysics, powering important industry and academic research.

GUANE-1 is now one of Colombia’s and Latin America’s most powerful supercomputers. It comprises 128 NVIDIA Fermi GPUs in 16 compute nodes—all running on HPE ProLiant SL390s G7 servers and using HPE MSA SAN Storage.

### BENEFITS

#### Enabling industrial development

While Barrios Hernández and his team have backed diverse projects from gene sequencing to climate prediction, they have particularly supported research and development for the oil and gas industry. Using GUANE-1, they’ve run seismic modeling for the Colombian Petroleum Company’s oil exploration in the country’s Santander region. This has paved the way for the discovery of new petroleum reserves and helped optimize local oil and gas production.

“Finding new reserves benefits our economy significantly,” says Barrios Hernández. “I believe the Colombian oil and gas industry has become more competitive internationally as a result of these new discoveries.”

#### Advancing medical research

The center’s support of bioinformatics research has been equally important amid outbreaks of infectious diseases around the world. Using HPC, researchers from UIS and the National Polytechnic Institute of Mexico created a database of all known viruses and analyzed their genome sequences, enabling them to develop a program that can diagnose the influenza A H1N1 virus in less than three hours. The researchers went on to win Mexico’s 2017 National Research Award from the Social Security and Services for State Workers Institute for the global impact of their work.

“Today, with that experience, we’re supporting local and international actions around COVID-19,” says Barrios Hernández.

SC3UIS, together with the Latin American Cooperation of Advanced Networks and the Advanced Computing System of Latin America and the Caribbean, has made computing power available to COVID-19 research projects. One of these is the metagenomic analysis of COVID-19 test results taken through polymerase chain reaction or PCR. This kind of examination can provide insights into the disease and the virus that causes it, helping find ways to guard against new threats.





The center has also lent capacity to an international distributed computing project that runs simulations to better understand COVID-19 proteins. By mapping these proteins, researchers hope to identify antibodies or drug compounds that can keep the virus from spreading and infecting people.

“We have two special platforms to support these efforts, both with NVIDIA TITAN and running on HPE ProLiant servers. One is public, named FELIX (Framework to Enhance artificial Intelligence applications eXecution), and the other is a private platform that supports COVID-19 medication at a semi-private clinic,” says Barrios Hernández.

The medication project is particularly noteworthy because it is a local effort. Researchers run data analytics to understand and improve the efficacy of some pharmaceutical treatments for a certain type of COVID-19 patients. While the initiative is still experimental, Barrios Hernández believes it is a big step forward for a country like Colombia to have the technological capability to support this kind of research.

“In the past, it was rare in Latin America to do research focusing on local communities and patients,” he adds. “Most healthcare

uses are developed for people in Europe or the United States. But COVID-19 is a global concern. Many countries are trying to advance their own local knowledge. I hope we can have strong results to better understand the behavior of COVID-19 here in Colombia.”

Before this project, Barrios Hernández and his team had also worked with local clinics to support cancer research through imaging and simulation, helping shed light on the effectiveness of some treatments.

#### **Understanding the pandemic's impacts**

Outside medical research, Barrios Hernández and his team have supported efforts to understand the socio-economic impacts of COVID-19 on Latin Americans and how city populations have changed since the pandemic started.

Job losses in the region due to COVID-19 have driven people out of cities and into mountainous and rural areas. By analyzing data on the pandemic's effects on employment and incomes, city governments can make better informed decisions on how to revive their economies.

“These regional collaborations and our ability to use supercomputers are helping push Latin America toward post-pandemic recovery and progress,” says Barrios Hernández.



## Case study

Universidad Industrial  
de Santander

## Industry

Higher education

**“It’s been great to see increased possibilities and resources for the region. Now, we’re hoping to integrate further our computing centers with the rest of the Americas so we can address the challenges we’re facing.”**

– Carlos Jaime Barrios Hernández, Director, High Performance and Scientific Computing Center at Universidad Industrial de Santander

## Customer at a glance

### Hardware

- HPE ProLiant servers
- HPE MSA SAN Storage
- NVIDIA GPUs
- VMware

### HPE Pointnext Services

- HPE Foundation Care
- HPE Maintenance Support Pack

## Driving excellence in academic research

With HPC resources at their disposal, UIS researchers have produced better scientific publications.

“They also get more opportunities for industry and international collaboration,” says Barrios Hernández.

The center has directly and indirectly published more than 160 academic papers. It also has at least three patented software solutions that now accelerate sequence analyses at bioinformatics centers and enable simulations for the oil and gas industry.

What Barrios Hernández is most proud of is how the international HPC community has recognized SC3UIS as a key supercomputing center in Colombia and Latin America. This recognition has unlocked opportunities to partner with other organizations and secure increasingly powerful technologies.

“We’re the only Colombian HPC center to become part of the RISC2 Project, an HPC coordination network between Europe and Latin America,” says Barrios Hernández. “That’s a big accomplishment for us.”

SC3UIS also became the first NVIDIA academic research center in Colombia and the second in Latin America. This entitles the organization to receive sponsorship for joint research programs—one of which involves remote visualization and interaction. Together with NVIDIA and Universidad de los Andes in Bogota, SC3UIS developed a remote analysis and visualization system called Yajé.

The platform ran on an HPE ProLiant ML350 Gen9 server with NVIDIA GeForce GTX TITAN X graphics cards.

Now in its second version, Yajé lets users run graphics-intensive applications and view simulations from remote devices to facilitate learning and research. The platform operates with VMware® and NVIDIA GRID M40 using container technology.

Yajé’s second iteration has generated so much interest from other supercomputing institutions that it has attracted more partners for SC3UIS. The center now also collaborates with the United States’ Oak Ridge National Laboratory and France’s National Institute for Research in Digital Science and Technology. They’re jointly working to develop Yajé 3.0.

Looking ahead, the center aims to build a more powerful supercomputing platform and to play a bigger role in Latin America’s supercomputing and scientific research communities.

“It’s been great to see increased possibilities and resources for the region,” says Barrios Hernández. “Now, we’re hoping to integrate further our computing centers with the rest of the Americas so we can address the challenges we’re facing.”

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