intel® XEON®

# Argentina to Host Latin America's Most Powerful Supercomputer Dedicated to Academic Research

Built on the Intel® Xeon® CPU Max Series, a processor family with High Bandwidth Memory (HBM), and Intel® Data Center GPU Max Series, the 15.7 petaFLOPS system will advance computational science for researchers in Argentina and across the region

Solution Summary

- 5,120 Intel® Xeon® CPU Max Series cores

- 37,888 Intel® Data Center GPU Max Series cores

- 15.7 petaFLOPS peak performance

- Supports academic research and government computing

intel® XEON® MAX SERIES

Lenovo

2-m Temperature and Streamlines
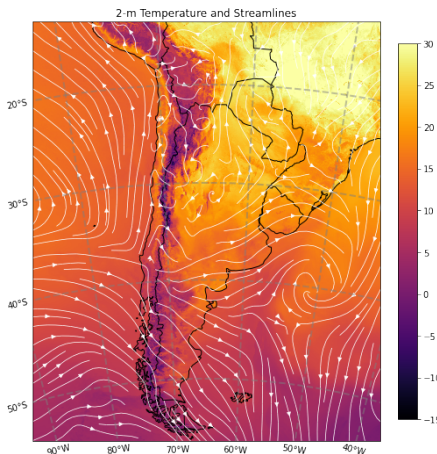
A Weather Research and Forecasting (WRF) output generated temperature figure from the Registry of Open Data on AWS.

Executive Summary

In a joint program between Argentina's Minister of Science, Technology and Innovation and Minister of Defense, Argentina will be home to the most powerful supercomputer in Latin America available to academic research. Housed in and managed by the data center for the Servicio Meteorológico Nacional (SMN), the 15.7 petaFLOPS system will provide computing to researchers across the country as well as to the entire Latin America and Caribbean region. To be deployed by mid-2023, it will also become the platform to develop next-generation weather modeling codes for the SMN based on the use of GPUs.

The new system is the first deployment in Latin America built on Intel® Xeon® CPU Max Series, a processor family with integrated High Bandwidth Memory (HBM), and Intel® Data Center GPU Max Series—Intel's latest generation GPU for HPC. With a design performance 40 times more powerful than SMN's current supercomputer, Huayra Muyu, the system is expected to land later this year within the top 100 systems on the Top500.org list of fastest computers in the world.

Challenge

Argentina has a long history of supercomputing, beginning with Clementina in 1960. Today, Argentina hosts many systems for academic research and public services. Among the most computationally intensive systems has been the Huayra Muyu supercomputer at the Servicio Meterológico Nacional (national weather service) for numerical weather predictions and forecasting. Huayra Muyu was deployed in 2019 in the SMN's data center in Buenos Aires. It runs ensemble forecasts and modeling using the Weather Research and Forecasting (WRF) model. The WRF code that SMN uses is designed around CPUs.

There have been several advancements in computing technologies within CPUs and GPUs over the last five years. Additionally, supercomputing initiatives within Argentina led by the country's Minister of Science, Technology and Innovation along with the Minister of Defense are taking Argentina to a new computing prominence in Latin America.

According to Pablo Mininni, coordinator of Argentina's National High Performance Computing System (SNCAD) of the Ministry of Science and Technology (MinCyT), in 2019 the organization surveyed the state of supercomputing in Argentina. The research revealed Argentina had 10 percent of the computational capacity needed by researchers across the country. So, a National Computing Center was created to provide scientific computing capacity to researchers around the country. The Center will be the head of a network of centers of the SNCAD.

Its first purchase is the first supercomputer deployment in Latin America of a system built on Intel Xeon CPU Max Series and Intel Data Center GPU Max Series. The 15.7 petaFLOPS system will be one of the two fastest HPC systems in Latin America, and the fastest resource dedicated to academic scientific research.

Solution

"The SMN evaluated different solutions in an international tendering, using benchmarks based on actual HPC applications with realistic workloads," Mininni explained.

Built by Lenovo, the 5,120 CPU core and 37,888 GPU core system—yet to be named—will comprise the following leading technologies:

- A 440 teraFLOPS partition built on Intel Xeon CPU Max Series
- A 15.3 petaFLOPS partition with 296 Intel Data Center GPU Max Series
- Direct liquid cooling
- 1.66 petabytes of memory
- 400 Gbps InfiniBand network

The new system will be hosted within SMN's data center in Buenos Aires.

"The system is designed to support a partnership between Argentina's public research community and institutions running applications, as for example our national weather service," he added.

SMN currently runs weather forecasts using WRF every three hours on their Huayra Muyu supercomputer. The new system's 440 teraFLOPS partition with Intel Xeon CPU Max Series will provide an additional resource to the SMN for running its WRF codes and support other academic research using CPUs. It is expected that the new system will enable SMN to increase the frequency and accuracy of weather forecasts.

"Besides as an alternative to run current weather models," added Pablo Loyber, Director of Technology Infrastructure and Data at SMN, "the new system will be a test bed for exploring the evolution of weather models for the next-generation supercomputer."

The SMN is exploring the [Model for Prediction Across Scales (MPAS)](#) microphysics codes for running on the new system with Intel Xeon Data Center GPUs. MPAS is a collaborative project for developing atmosphere, ocean and other earth-system simulation components for use in climate, regional climate and weather studies.[1] MPAS contributors include the Los Alamos National Laboratory climate modeling group (COSIM) and the National Center for Atmospheric Research (NCAR) in the United States.

"The idea is to see weather forecasts can be done for production using GPUs, while simultaneously providing a resource for the entire research community in Argentina," Mininni stated. "With the Lenovo configuration, we saw over 20 percent speedup of WRF using the exact software configuration SMN uses," Mininni commented. "There were no extra optimizations done for this platform. That's really good news."

Result

The new system delivers 40 times more computing than the current Huayra Muyu supercomputer and many times more powerful than current systems available to public researchers.[2]

"The Intel Xeon Max series provided the best performance for numerical weather forecast," Mininni said, "with no tweaking required, being at least 20 percent faster than other CPUs. For the GPUs, benchmarks using molecular dynamics software outperformed other choices, delivering an impressive number of TFLOPs per GPU."

That offers a level of computing capacity open to public research not seen in Argentina before. Loyber added, "We expect a very significant increase in acceleration, made possible by the use of Intel Data Center GPU Max and GPU-compatible MPAS weather forecast software."

"The FLOPS for the system were designed taking into account the requirements we have from the community," Mininni explained. "So, there is a community of users that already runs in CPUs and in GPUs. They have international collaborations, and they are used to running HPC systems. But this is a new technology. We will have to help them migrate to it. And that will be a challenge. It will be a nice challenge because the amount of computing power that is provided is tempting for most users."

Researchers in astronomy, physics, chemistry, life sciences, and artificial intelligence will likely be the first to use the new Intel Xeon Data Center GPU Max Series to run their codes. Other users in physics, astronomy, and other sciences will look to run their applications on the new CPUs.

"My impression is they will be quite happy with the fast memory they will find in the CPUs based on the benchmarks I have seen and for some tests I was able to do myself," Mininni commented. "My impression is that they will find that their codes are significantly faster."

Solution Summary

To build for the future, Argentina created a National Computing Center that provides HPC resources to researchers across the country. The Center's first deployment will be a 15.7 petaFLOPS system designed by Lenovo and built on Intel Xeon CPU Max Series with HBM and Intel Data Center GPU Max Series. The new system will be hosted and managed by Argentina's national weather service, SMN. But only 10 percent of the system's capacity will be dedicated to SMN codes. The remaining 90 percent will be available for public researchers in universities and industry.

Where to Get More Information

Learn more about [Servicio Meteorológico Nacional](#).

Explore the capabilities of the [Intel Xeon CPU Max Series](#) and [Intel Data Center GPU Max Series](#).

Solution Ingredients

- 5,120 Intel® Xeon® CPU Max Series cores

- 37,888 Intel® Data Center GPU Max Series cores

- 15.7 petaFLOPS peak performance

- Supports academic research and government computing

[1] https://mpas-dev.github.io

[2]

Key Components	Huayra Muyu	New System
Platform information	Operational system for Weather Forecast	Research system. SMN will have the 10% of computer time for research new forecast models.
#systems	128*	80
Name	ThinkSystem SD530	Lenovo ThinkSystem SD650v3
BIOS	3.41	3.41
Processor information	Intel(R) Xeon(R) Gold 6142 CPU @ 2.60GHz	Intel® Xeon® CPU Max Series
# CPUs	2	2
HT on/off	On (unused)	On (unused)
Turbo on/off	On	On
Memory	DDR ECC	HBM2e + TruDDR5
Total/System (#DIMM X Capacity)	128G (16 x 8G)	64G (HBM) + 512 (DDR5)
Tech Speed	DDR4 (2666 Mhz)	TruDDR5 4800MHz
OS/Kernel	Red Hat Enterprise Linux Server 7.9 (Maipo) / Linux 3.10.0	Red Hat Enterprise Linux Server 7.9 (Maipo) / Linux 3.10.0
Application Version	WRF Model Version 3.8.1	WRF Model version 3.8.1 / MPAS Atmosphere 8.0.0
Libraries	- HDF5 1.8.14 - NetCDF 4.3.3.1 - PNetCDF 1.6.0	PGI 19.10 compilers zlib 1.2.11 HDF5 1.10.5 PnetCDF 1.12.1 netCDF-C 4.6.3 netCDF-Fortran 4.5.2 PIO 2.4.4
Test Date	May 2018	May 2023

* Huayra Muyu has 128 nodes, but the benchmark was performed employing 120 nodes to simulate a typical operational cycle.