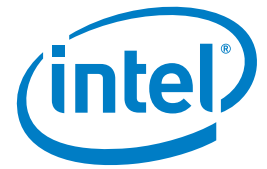


CASE STUDY

Intel® Xeon® processor 5500 series

High-Performance Computing
Data-Intensive Computing



Mapping the Globe from Space

European Space Agency benefits from high-performance Intel® technology for critical research

The European Space Agency (ESA) combines the financial and intellectual resources of 18 countries to drive European innovations in space science and travel while building knowledge about our own planet. At its Italy-based Centre for Earth Observation, ESRIN, a team of more than 600 scientists is responsible for processing data from satellites. The information they gather is essential for understanding the environment system of our planet as well as tracking, predicting and responding to natural events and climate change on Earth. Luigi Fusco, Senior Advisor for Earth Observation Applications of ESRIN, ESA, explains: "The satellite observations are important because they are objective and reliable. The acquired data enables us to conduct accurate research into phenomena related to climate change on a vast scale."



CHALLENGES

- **Be prepared.** Help local and national governments better monitor and identify regions at risks for environmental issues and respond faster and more accurately to natural disasters
- **Track climate change.** Support the development of international environmental policies through detailed analysis of objective information
- **Accommodate data growth.** Implement a powerful computing platform to drive detailed research breakthroughs as the data volumes continue to increase and the data integration becomes more complex

SOLUTIONS

- **High Performance Computing.** Six Blue Rider* servers, powered by leading Intel® Xeon® processor 5500 series, underpin enhanced data analysis platform with advanced scalability

IMPACT

- **Faster results.** Superior performance of new platform has driven a 50 per cent** boost in efficiency of computing platform, meaning faster results with no added operational cost
- **Improved response.** For example, faster analysis and mapping of flood means alerts to civil protection operators can be raised earlier, and response to disasters are faster and more informed

Groundbreaking research goals

The data that ESRIN researchers capture from the ESA satellites enables them to conduct a range of analyses. For example, they are able to investigate changes in sea levels over long periods of time and – closer to home – how much Mount Etna rises and lowers depending on the level of volcanic and seismic activity underneath it. Its main satellite is called Envisat, and many of the images it captures are made available to the public through the ESA Earth Observation Programme websites, e.g. miravi.eo.esa.int.

While these observations of the planet and its geography are significant from an academic and general interest perspective, one primary importance is in preparing for and reacting to natural disasters. ESRIN uses its satellite data to work with the International Charter for Space and Major Disasters, a network of space agencies focused on processing data in the event of disasters and delivering real-time information to civil defense bodies. It has recently supported the response to major events including the Boxing Day tsunami in 2004, Hurricane Katrina in 2005 and the fires in Greece in 2007.

ESRIN is fully involved in the ESA and European Commission's Global Monitoring for the Environment and Security (GMES), the region's environmental monitoring and protection programme. This captures climate change and ecological information via satellite and shares it with national and regional governments to assist the definition and implementation of environmental and civil safety policies across Europe.

ESRIN's substantial computing resources are shared with the wider scientific community through a grid known as GPOD (Grid Processing on Demand). The ESA grid offers users access to an operating environment with guaranteed calculation power. Fusco explains: "The ESA grid is evolving to include heterogeneous data sources, from ground sensors and airplanes to satellites, accessible from one location. Users can collaborate to manipulate this data using distributed grid resources to drive new discoveries and services, as tested in the GENESI-DR project (genesi-dr.eu). It is therefore imperative that the platform offers guaranteed memory and computing resources."



"We're constantly collecting information on the environment that needs to be processed by our dedicated computing platforms. It's important that we process and file this mass of information, compare it to historical data and act on the findings in real time. The enhanced performance of the Intel® Xeon® processor 5500 series will make this possible in a much easier manner."

Luigi Fusco
Senior Advisor of ESRIN, ESA



European Space Agency helps enhance understanding of our own planet thanks to Intel® Xeon® processor 5500 series

Building on strong technological foundations

In order to enable such a wide range of activities on an ongoing basis, ESRIN needs a powerful computing platform. Reliability is also key as in the event of a natural emergency, it must be able to respond in real-time to deliver critical information to governments and aid organisations around the world.

Its dedicated GPOD architecture consisted of about 1,000 processing cores and 200 TB of storage, integrated gradually over a few years. The ESA was keen to assess ways to improve its performance and reduce power consumption as part of a possible upgrade and renovation of the whole infrastructure.

The Envisat satellite sends 100 megabits of data every second, but the ESA is planning to launch a new group of satellites for a series of Earth Observation missions known as Sentinels, which will be capable of sending four times this amount initially, increasing to 1GB/second when fully operational. This is expected to increase the amount of memory used from 5PB today to 15PB by 2020. "We're constantly collecting information on the environment, mostly in the form of data that needs to be processed by our supercomputing platform," says Fusco. "It's important that we can process and file this mass of information, compare it to historical data and act on the findings in real time."

To support the expected data growth and continue to deliver the same high-quality performance, scalability and reliability, Esrin needed to enhance its existing Intel Architecture.

It chose to deploy an additional platform based on Intel® Xeon® processor 5500 series in order to benefit from its enhanced intelligence and adaptability. The solution - now the most powerful cluster in the GPOD system - consisted of six servers and was installed in just a few hours. The platform delivers 70-125 per cent better performance than the previous generation of processors, and has enabled a 50 per cent boost in efficiency for Esrin thanks to the ability to 'switch off' unused cores.

"Our Blue Rider* line of platforms, based on the new Intel Xeon processor 5500 series, opens up new potential for compute-intensive processing and for data centres," comments Vincenzo Nuti, CEO of E4 Computer Engineering. "The partnership which we have consolidated over the years with Intel, has given us the opportunity to be one of the first to test this line of processors which, as already discovered during the initial testing, is able to guarantee very high levels of performance combined with a considerable energy saving. These are fundamental characteristics to be able to offer our clients - innovative solutions which guarantee a very fast return on investment."

Responding faster to natural disasters

Since deploying the new platform, Esrin has seen a dramatic reduction in the time taken to deliver results from its analysis of the satellite data. One of its most important local activities - monitoring 8,000 seismically 'at risk' areas in Italy such as Etna and the volcanic crater in the

Spotlight on ESA

The European Space Agency's (ESA) mission is to shape the development of Europe's space capability and ensure that investment in space continues to deliver benefits to the citizens of Europe and the world.

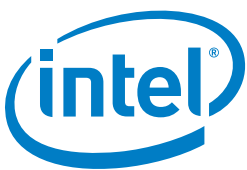
It is an international organisation with 18 member states in Europe, and partnerships with space agencies across the globe. ESA projects and initiatives are designed to find out more about the Earth, its immediate space environment, the Solar System and the Universe. It also developed satellite-based technologies and services to help promote European industries.

Bay of Naples - is now much improved, with risk changes being mapped 50 per cent faster than before. This is a crucial part of the early-warning strategy for earthquakes and volcanic eruptions in the region and means that the alarm can be raised in the event of an impending disaster days earlier, resulting in reduced casualties. "Even in the case of the earthquake in L'Aquila at the beginning of April 2009, we were able to produce a model of the stricken area in little more than three hours: before, this platform was installed, it would have taken more than six," concludes Fusco.

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** As performed in a dedicated comparative test for SAR interferometry computation

*** Sentinel-1 is a polar-orbiting, all-weather, day-and-night radar imaging mission for GMES land and ocean services. The first Sentinel-1 satellite is planned for launch at the end of 2011.

Sentinel-2 is a polar-orbiting, multispectral high-resolution imaging mission for GMES land monitoring to provide, for example, imagery of vegetation, soil and water cover, inland waterways and coastal areas. Sentinel-2 will also provide information for emergency services. The first Sentinel-2 satellite is planned for launch at the end of 2012.

Sentinel-3 is a multi-instrument mission to determine parameters such as sea-surface topography, sea- and land-surface temperature, ocean colour and land colour with high-end accuracy and reliability. The first Sentinel-3 satellite is planned for launch in 2013.

Sentinel-4 is a payload that will be embarked upon a Meteosat Third Generation (MTG) satellite in geostationary orbit and launched in 2017. Sentinel-4 is devoted to atmospheric monitoring.

Sentinel-5 is a payload will be embarked on a post-EUMETSAT Polar System (EPS) spacecraft and launched in 2019. A Sentinel-5 precursor mission is planned to launch in 2014, to avoid data gaps between Envisat (Sciamachy data in particular) and Sentinel-5. This mission will be devoted to atmospheric monitoring.

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