Cosmology in the age of in-memory computing

Since the dawn of humanity, we’ve been curious about where we come from. A hundred years ago, Albert Einstein searched for answers in thought experiments. But theories must be tested through confrontation with real data—and today, technology lets us probe the mysteries of our universe as never before possible. The United Kingdom’s COSMOS advanced computing facility, founded by renowned physicist Stephen Hawking and colleagues, is transforming terascale data sets into a front row seat to the Big Bang. For breakthrough computing power to run real-time analyses and complex simulations, COSMOS relies on another discovery pioneer: Hewlett Packard Enterprise.

**CHALLENGE**

Data-driven discovery requires massive computing power

Satellites orbiting earth. Ground-based instruments picking up traces of ancient radiation. Humans have devised ingenious ways to collect clues about the origin of our universe. Transforming those clues into insight takes enormous computational muscle—both to analyze sensor data and to simulate cosmic events such as the merger of black holes.

**SOLUTION**

In-memory computing to drive more insights, faster

The tenth and latest COSMOS high performance system goes where no computer has gone before. Featuring the new HPE Superdome Flex in-memory platform, the COSMOS group can turn data into actionable insight at unparalleled scale and in real-time.

“In-memory computing allows us to ingest all of this data and act on it immediately, trying out new ideas, new algorithms. It accelerates time to solution and equips us with a powerful tool to probe the big questions about the origin of our universe.”

Paul Shellard, Professor of Cosmology, University of Cambridge, and Coordinator of COSMOS

**RESULTS**

New research horizons

The cosmology team leverages the COSMOS system to achieve two principal objectives: develop a seamless history of the Big Bang and to understand the gravitational waves of black holes. The team forms theories about the origins of the universe, creates simulations to extremely high precision and makes predictions, and then looks for those predictions within a flood of new data. With a large in-memory computing system, the team can analyze the data through visualization and in real-time while the simulation is running. The COSMOS system is also leveraged extensively by the Faculty of Mathematics at the University of Cambridge to solve problems ranging from environmental issues to medical imaging.

“The recent discovery of gravitational waves offers amazing insights about black holes and the whole universe. With exciting new data like this, we need flexible and powerful computer systems to keep ahead so we can test our theories and innovate.”

Stephen Hawking, Director of Research at the Department of Applied Mathematics and Theoretical Physics and Founder of the Centre for Theoretical Cosmology at Cambridge

**BY THE NUMBERS**

>50 researchers leveraging the COSMOS system

Terabytes of cosmological data held in-memory for real-time analysis and simulation

0 times before in history that humanity has been able to probe the cosmos with such power

**TRENDS**

In 1610, Galileo pointed a hand-built telescope at the heavens. Today, powerful computers let scientists query enormous data sets captured by a range of powerful instruments. The stage is set for another age of cosmological advancements—right down to the kinds of questions cosmologists can ask.

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