The Met Office

National Weather Service of the United Kingdom

Case Study

Global Warming and the One-Petabyte Database

Summary

In May 1990, scientists at the Met Office's Hadley Center for Climate Prediction and Research began an intensive investigation into the implications of global warming, one of the world's most critical and challenging ecological concerns. The Hadley Centre employs some of today's finest meteorological minds to conduct weather-related research that is powered by advanced supercomputers. Hadley Center scientists continually collect weather information from a worldwide network of automatic and manual observation stations. By analyzing and feeding this observational data into a numerical weather prediction model originally developed for short-term weather forecasting, scientists can project future global warming trends with increasing confidence.

When the challenge of managing the huge amount of collected weather data became too demanding for its legacy database and storage system, the Met Office selected FileTek, Inc., a company specializing in data management solutions, to provide a better way to store, access, and manage its vital information. The outcome will result in an *over one-petabyte* data management system – one of the largest in the world.

Organization Background

The Met Office, located in Exeter, England, was formed in 1854 to provide meteorological and ocean current information to mariners. By 1861,the Met Office issued storm warnings to ports and forecasts to the press based on observations received by telegraph from the U.K. and France. In 1922, the BBC began broadcasting the weather, and in 1936, TV stations began reporting it. During both world wars, the Met Office was indispensable in providing accurate forecasts to the Royal Navy and Royal Air Force.

In May 1990, the Met Office opened its Hadley Centre for Climate Prediction and Research. Today, the Met Office employs approximately 2,300 people worldwide. Harnessing the power of advanced NEC supercomputers, it is one of the most technologically advanced government organizations and a world leader in global warming research.

The Challenge

In 1996, six years after the global warming investigation began, the Met Office realized it had a dilemma. "As the data amounts grew, we were faced with a number of different challenges," said Paul Cowley, former Principal IT Consultant/Information Systems Strategy at the Met Office. "First, we knew that if we kept on collecting data at the same pace, we were soon going to run out of storage space. Second, the tape cartridges we were using had too low a data capacity for our needs, plus an unacceptable error rate. And third, we were using a lot of internal resources to write programs to manage the data, which was not a good use of their time."

In 1997, the Met Office decided to update its current system. They consulted with the government's Central Computer and Telecommunications Agency (CCTA) and wrote and released an Operational Requirement to potential vendors. In 1999, after a thorough and competitive process that included benchmarking and proof-of-concept presentations, the Met Office chose FileTek as the prime contractor for its new Managed Archive Storage System (MASS).

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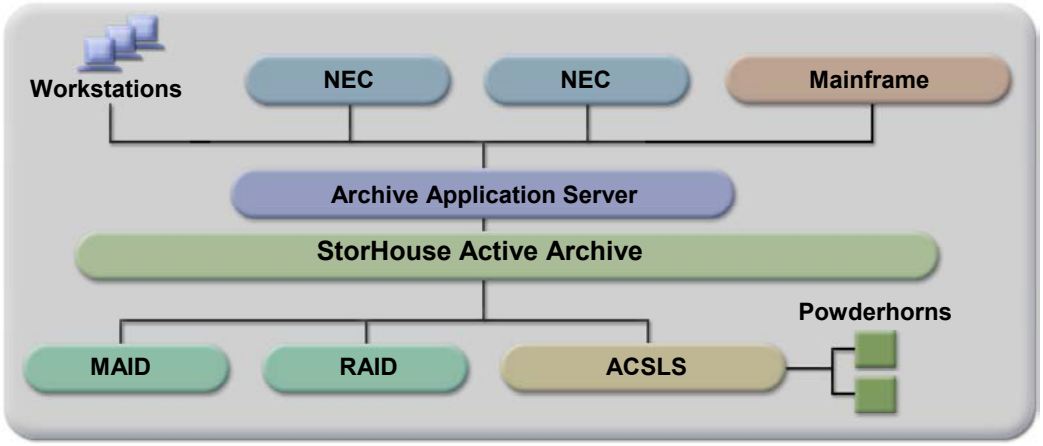
The Solution

"As we proceeded along the procurement process, we realized that the storage part of the solution was really secondary," said Cowley. "The main issue was managing the data. It was crucial to the operation of the whole system."

Beginning in 2000, the Met Office implemented FileTek's StorHouse® product to manage its hundreds of terabytes of information. StorHouse software, including the StorHouse/RM relational manager, runs on a Sun Microsystems™ platform using Solaris™ 2.9. The system initially incorporated Sun StorageTek™ 9840 tape drives and media held in a PowderHorn™ 9310 silo and subsequently added Sun StorageTek™ 9940 and T10K tape drives and a second 9310 silo. In 2005, the Met Office added a 56-terabyte Massive Arrays of Idle Disks (MAID) storage system to increase capacity and improve performance. MAID is composed of SATA disks, which are spun up only when accessed, thus providing a significantly smaller physical and carbon footprint.

The following figure illustrates the MASS architecture.



StorHouse can manage, store, and access single rows of detail data across all media types, including tape and MAID. This feature enables the system to directly access and manage high volumes of unsummarized data without moving complete files to disk

"Our file sizes average 80 MB," said Cowley. "To have moved multiple files to disk would have created a severe bottleneck and would have also required us to install many more hard drives. StorHouse's ability to manage vast amounts of data and get only the data we needed, not the whole file, was a major factor in choosing FileTek. This feature was key in reducing network load. Other factors for choosing FileTek and its StorHouse solution included scalability, support of existing technology, and FileTek's corporate commitment to support new technology when it becomes available. Also by having StorHouse automate our data management, we are able to free up our programming resources for other critical areas."

In early 2007, the Met Office database of climate research information managed by StorHouse reached 1.4 petabytes (1,400,000,000,000,000s of bytes) in size and is growing at the rate of 1.4 terabytes per day.

"One thing we can say based on our research is that there will be global warming and climate change in the future," said Cowley. "With the technology the Met. Office has harnessed, we believe that we are well on the way to understanding the magnitude of this change."

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