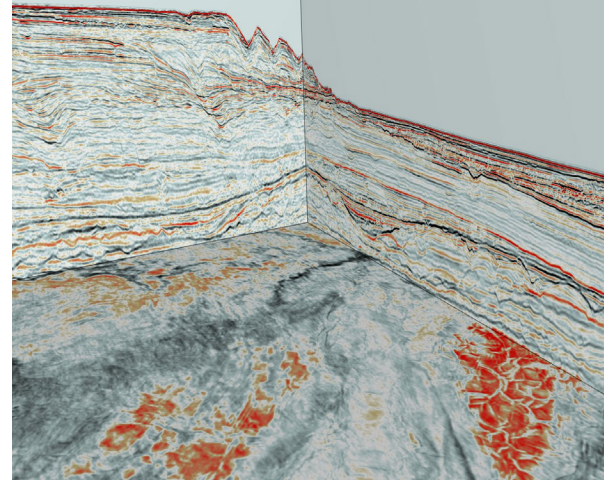




Subsurface Understanding

Transformational efficiency, performance, and scalability for energy exploration.



Subsurface image. Courtesy of Shearwater.

Introduction

Seismic imaging is a crucial technique used in the oil and gas industry to identify and locate oil and gas reservoirs beneath the earth's surface. The seismic process involves collecting wave propagation data using sensors and then processing this data to create an image of the subsurface. However, this processing is both time and data intensive, especially as demand for imaging resolution grows. This has led to the increasing adoption of NVIDIA GPUs. Compared to traditional operations using CPUs, NVIDIA GPUs perform complex calculations faster and with greater **energy efficiency**.

Applications

GPUs have significantly accelerated the development of two key seismic imaging techniques—reverse time migration (RTM) and full waveform inversion (FWI). These techniques require extensive numerical computations to process large amounts of seismic data. GPU acceleration has allowed RTM and FWI to be applied to larger and more complex datasets, resulting in a higher-fidelity image with lower uncertainty and significantly improving the identification of oil and gas reserves. Through NVIDIA software platforms, performance can be further accelerated by a factor of over 2X compared to hardware-only acceleration.

Use Cases

While seismic imaging is commonly used in oil and gas exploration, geothermal exploration, civil engineering, environmental studies, and archaeology, it has also become increasingly important in carbon storage for site characterization, injection monitoring, leakage detection, and risk assessment. Seismic imaging ensures the safety and effectiveness of carbon capture and sequestration (CCUS) projects by providing detailed information about subsurface geology and hydrology. It plays a critical role in monitoring the movement and distribution of carbon dioxide stored underground and identifying potential hazards, such as pressure or leaks, that could compromise the integrity of the storage reservoir.

Accelerate, Reclaim, and Save

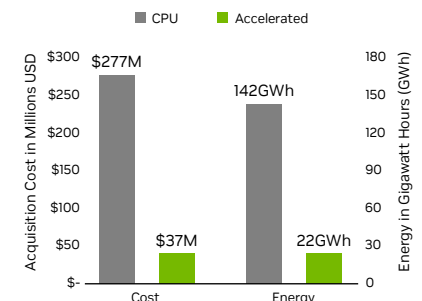
Seismic imaging has become vital to discovering and monitoring sites capable of safely storing carbon. The **NVIDIA accelerated computing platform** delivers these insights efficiently and affordably. At performance parity, when comparing a 500-node GPU system and a 12,000-node CPU system, the GPU system requires \$240 million less acquisition cost and consumes 120GWh less energy annually.

To learn more, visit: nvidia.com/sustainable-computing

Key Points

- > Hundreds of applications and algorithms
- > Billions of CPU hours consumed annually
- > 5–16X performance speedup
- > \$240 million and 120 gigawatt hours (GWh) saved annually

7X Lower Cost and 6X Less Energy



Based on measured performance of RTM and FWI applications. CPU: Intel Sapphire Rapids. GPU: NVIDIA A100 80GB Tensor Core.

“Leveraging accelerators was the most economical and energy-efficient way to meet the growing business demand in our existing data center.”

Charlie Fazzino,
HPC and Subsurface IT Manager,
ExxonMobil