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MicroSeismic Evaluating HPC in the Cloud for Scalable, Cost-Effective Data Analysis

Proof of concept using Intel® powered instances in the AWS Cloud demonstrates the potential for cost savings, faster data processing, and increased business opportunity

PoC testing with an HPC on AWS solution built on Intel's AI-ready HPC technologies offers several benefits:

- Preliminary benchmarking by Amazon Web Services (AWS) demonstrates how C5d deployments can offer MicroSeismic up to a 10x workload performance improvement over their existing on-premises HPC solution.

- With the aid of HPC in the cloud instances, MSI's long-term goal is to perform analysis in real-time.

- Faster cloud-based workload processing time would free MSI's development staff to perform more high-value activities like optimizing code, batch sizes, and more, for speedier client results.

- HPC in the cloud could help MSI's geophysicists spend more time interpreting data rather than on the mechanics of processing the data.

For more complete information about performance and benchmark results, visit intel.com/benchmarks.

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Executive Summary

MicroSeismic, Inc. (MSI) offers its clients in the energy sector a variety of services for targeting and monitoring hydraulic fracturing operations to optimize oil production. The process involves the use of distributed sensors that collect massive volumes of data. High performance computing (HPC) systems then analyze that information for meaningful insights and 3D visualization of subterranean oil deposits. To date, MSI performed that data evaluation on its dedicated HPC cluster housed at a nearby data center. However, a new proof-of-concept (PoC) deployment performed with the aid of Six Nines IT demonstrates how MSI can benefit from migrating some of their HPC workloads to cloud instances optimized for HPC and AI with Intel technologies. Expanding their options to Amazon Web Services (AWS) using Intel® processor-based instances with support for Intel® Advanced Vector Extensions 512 (Intel® AVX-512) and Intel® DL Boost technology has demonstrated the potential to increase the elasticity for large workloads, accelerate time to insight during data analysis, and lower the cost-per-terabyte during data processing.

Challenge

MicroSeismic's services help its clients optimize the development of unconventional oil and gas fields. By understanding how far apart to position wells to better maximize value, clients can balance the cost of drilling and completing wells against production worth.

HPC systems process vast amounts of sensor data to visualize and extract rock properties miles underground and identify the ideal number and placement of wells to drain the oil and gas efficiently. MSI historically executed these data analysis workloads using HPC systems in their local datacenters. Today, MSI is facing a growing demand for flexibility to scale-up and scale-down their HPC infrastructure, along with a need to control CapEx costs, all while continuing to provide insights faster.

Solution

MSI worked with AWS Partner Network (APN) Premier Consulting Partner Six Nines IT to develop a PoC cloud-based HPC option capable of accommodating complex sensor data analysis workloads. The team evaluated a number of AWS solutions, including CPU and GPU optimized instances and found the sweet spot for their application with Amazon Elastic Compute Cloud (Amazon EC2) C5d instances supported by Intel technologies. The search to supplement MSI's on-premises HPC infrastructure led to a proposal involving AWS's HPC solutions offering MSI the right balance of elasticity, cost, and speed to accomplish their challenging client work efficiently.

Results

The PoC solution along with the optimizations of their custom data software to run in cloud instances demonstrated several potential benefits. In addition to access to a range of Intel powered instances on AWS, MSI could control their operational costs based on the desired time to insight by selecting the most optimal instance. They can also optimize code to make it "cloud-native," thereby increasing performance of their application. Also, cloud-based HPC systems can make use of the latest hardware. Their results showed that the C5d instances, based on underlying Intel Xeon Scalable processors offered excellent performance characteristics to meet their business commitments.

"Seeing" what lies underground

When oil producers identify underground deposits, they rely on MicroSeismic to help them monitor the effect of hydraulic fracturing on the rock where the oil and gas are stored. These deposits can only be produced after breaking the rock by injecting water at very high pressures. Monitoring allows MSI's customers to reduce costs by identifying the most effective fracturing treatment and the ideal distance between production wells. The effort also helps minimize the impact of the oil extraction process on the surrounding environment.

MicroSeismic accomplishes this task by placing a massive antenna array with thousands of surface sensors, called geophones, above the well where the rock is being broken. The process is similar to earthquake monitoring but on a massive scale. Each sensor records the sound of the rock cracking, collecting many terabytes of data in the process. MSI's HPC systems process all that information after breaking it into smaller batches of data representing five minutes of monitoring time. From there, MSI's proprietary software running on HPC infrastructure uses that information to extrapolate a comprehensive, three-dimensional map of the rock-breaking "events," animated in time, so clients can see what is happening miles underground.

To remain competitive in the global energy industry, MSI seeks to provide its customers the valuable insights as rapidly as possible. Cloud instances featuring Intel HPC technologies help accelerate that process by supplementing on-premises clusters.
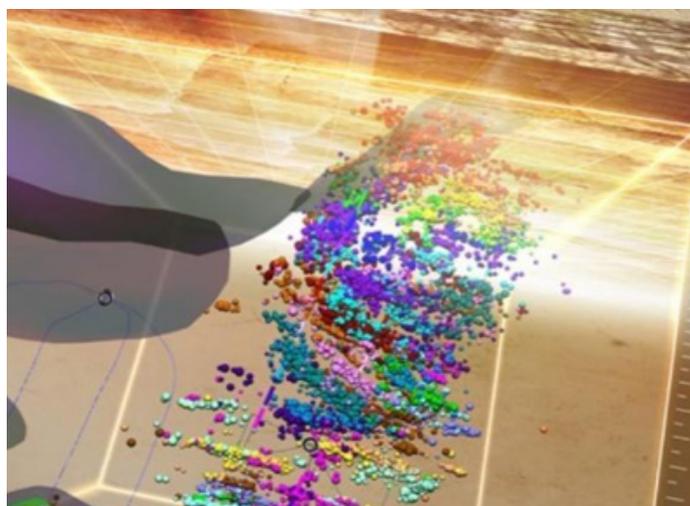
MicroSeismic's massive antenna array of thousands of surface sensors, called geophones, records the sound of the rock cracking, collecting many terabytes of data in the process.

Spotlight on MicroSeismic, Inc.

Founded in 2003 with its headquarters in Houston, Texas, MicroSeismic, Inc. (MSI) is an oil field services company providing completions evaluation services for monitoring hydraulic fracturing operations in unconventional oil and gas plays. MSI invented the use of surface MicroSeismic monitoring to listen to the acoustic signal emitted from a reservoir during stimulation. Using surface, near-surface, and downhole arrays, MSI helps oil and gas companies understand how the reservoir responds to hydraulic fracturing, its impact on field development, and completion design decisions. Also, MSI solutions help determine estimated ultimate recovery, a measure of the total economic production over the lifetime of an oil or gas well. MSI has monitored and analyzed over 45,000 frac stages across the United States and 18 countries internationally with an exceptional safety record of over 2.2 million person-hours without a Lost Time Incident.

Spotlight on Six Nines IT

Headquartered in Oakland, California, Six Nines is a Premier Consulting Partner in the AWS Partner Network (APN) and has facilitated hundreds of successful customer migrations to the cloud. Six Nines specializes in High-Performance Computing (HPC) and offers a full range of expert-level cloud consulting services to accelerate cloud adoption and reduce risk. Its unique combination of speed, agility, technical expertise, and experience helps customers achieve rapid time to value while remaining secure and compliant. Six Nines founded in 2008 with the concept that companies would need a new type of partnership to help them move responsibly to the emerging cloud ecosystem.

"Based on MicroSeismic's proof-of-concept analysis, Amazon EC2 C5d instances and underlying Intel technologies offer the potential to deliver faster results and greater value to our clients at a lower cost. Data sets that previously required an overnight analysis could reveal meaningful insights in as little as thirty minutes."

- Peter Duncan, President and CEO of MicroSeismic, Inc.

Spotlight on Amazon Web Services (AWS)

For almost 14 years, Amazon Web Services has been the world's most comprehensive and broadly adopted cloud platform. AWS offers over 175 fully featured services for compute, storage, databases, networking, analytics, robotics, machine learning and artificial intelligence (AI), Internet of Things (IoT), mobile, security, hybrid, virtual and augmented reality (VR and AR), media, and application development, deployment, and management from 69 Availability Zones (AZs) within 22 geographic regions, with announced plans for 16 more Availability Zones and five more AWS Regions in Indonesia, Italy, Japan, South Africa, and Spain. Millions of customers—including the fastest-growing startups, largest enterprises, and leading government agencies—trust AWS to power their infrastructure, become more agile, and lower costs. To learn more about AWS, visit aws.amazon.com.

Transforming business with cloud-based HPC solutions

In 2019, MSI performed approximately six million data analysis tasks, requiring about 1.5 million hours of computing time on their dedicated HPC cluster hosted at a nearby data center. In MicroSeismic's business sector, time is money. By reducing the hours required for thousands of compute jobs, the organization's staff can focus even more attention on customer service. They can also provide real-time results to help their customers' operational decision-making process.

Working closely with Six Nines IT, a Premier Consulting Partner in the AWS Partner Network, MicroSeismic is currently evaluating options to augment their HPC system in the local data center. Through an extensive evaluation process, the team is narrowing their search to a few HPC in the cloud provider solutions. A PoC on AWS using C5d instances featuring Intel Xeon Scalable processors with Intel AVX-512 demonstrates how MSI can garner the needed combination of speed, flexibility, and cost-effectiveness to process data quickly. These benefits can help MSI provide its customers with new insights faster than previously possible. The AWS solution includes an HPC master node that dynamically spins up other compute/worker instances as needed to accommodate data-centric workloads, and then shuts down the process when a job is complete.

If the cloud deployment proceeds, Six Nines IT also plans to assist MSI in code optimizations that ensure MicroSeismic's proprietary applications perform to their full potential in the new HPC environment.

Solution Ingredients

Amazon EC2 C5d instances with 2nd generation Intel® Xeon® Scalable Processors featuring the Intel Advanced Vector Extensions 512 (AVX-512) instruction set

- AWS ParallelCluster
- AWS FSx for Lustre

Learn More

Read more about HPC on AWS

Learn about MicroSeismic, Inc.

Find out more about Six Nines IT

Learn more about Intel HPC solutions

See more about 2nd generation Intel Xeon Scalable Processors

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