



THE AMD OPTERON™ PROCESSOR HELPS MARATHON IMPROVE OIL & GAS PRODUCTION

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—Dr. Tom R. Evans, Senior Technical Consultant, Seismic and System Services, Marathon Oil Corporation

Challenge:

- Marathon Oil Corporation conducts complex seismic processing and imaging, visualization and interpretation in order to successfully drill new wells for oil and gas production.
- Market conditions—competition for access to resources, increased amounts of data, and an aging expert population—dictated a new kind of IT infrastructure for the company.
- Marathon Seismic and System Services Senior Technical Consultant Dr. Tom R. Evans and his team created an innovative thin client model to address these concerns. In order to build it, the company was searching for the industry's best price/performance, as well as flexibility in order to ensure a best-of-breed IT environment.

Solution:

- Marathon deployed the AMD Opteron™ processor throughout its infrastructure, including:
- Appro clusters based on AMD Opteron processors to conduct its seismic processing and imaging;
- AMD Opteron processor-powered HP xw9300 Workstations for its visualization desktops, thin client visualization and visualization center; and

- AMD Opteron processor-based IBM® BladeCenter LS20 servers to support information delivery to thin clients.

Impact:

- Marathon can now run projects up to four times faster at one-third the cost, directly contributing to Marathon completing successful wells.
- The AMD Opteron™ processor has contributed to increased flexibility and security, helping Marathon to realize exceptional efficiencies through its restructured information delivery methodology.
- AMD's technology approach afforded Marathon freedom of choice, allowing the company to leverage and incorporate multiple vendors' hardware and software technologies into its infrastructure.

Organizational Profile

Marathon Oil Corporation is engaged in the worldwide exploration and production of crude oil and natural gas, as well as the domestic refining, marketing and transportation of petroleum products. Headquartered in Houston, Texas, Marathon is among the leading energy industry players, applying innovative technologies to discover valuable energy resources and deliver the highest quality products to the marketplace. With operations that embrace three continents, Marathon strives to be the company of choice for applicable investors, partners, customers, neighbors and employees. For more information about Marathon, visit www.Marathon.com

Challenge

Seismic acquisition, processing and imaging are critical components in today's petroleum exploration and development workflow. This workflow or seismic data analysis is a time- and resource-intensive process in which technology can and must play a critical role in helping to provide quality and efficiency at a competitive cost. Once an area, or lease, has been identified as potentially prospective for oil and gas, Marathon must take the following next steps as part of the seismic workflow:

1. **Seismic processing and imaging:** Vast amounts of data, often many terabytes, are collected for each seismic survey taken in pursuit of a new prospect or a proposed field development. The data is extensively analyzed, processed, and imaged to produce a three-dimensional (3D) picture of the

- subsurface. The process utilizes advanced imaging technologies which are incredibly compute-intensive.
2. **Visualization:** Once the image is established, it is viewed in the context of an earth model to analyze and then create a business case for drilling. A database gives context such as reference locations, drilling entitlements, and other wells in the area. Then state-of-the-art information systems render the 3D image in order to allow dynamic viewing, editing and interpreting of the resulting image. This is a highly compute- and graphics-intensive process given the complexity and volume of data being analyzed.
 3. **Interpretation:** Given a final composite seismic image and the input from visualization, the results are then interpreted to produce a three-dimensional model representation of the subsurface which can be integrated with rock properties derived from well data, field analogues or the seismic data itself. The result is then analyzed for commercial viability prior to a final decision to commit further significant risk money to drilling and/or developing it as a field. Information technology at this stage of the workflow must be very flexible, allowing easy local and remote access to the data as diverse and sometimes remote expertise is employed to produce the final products for commercial decision-making.

The petroleum industry is constantly being thrown new challenges that need to be addressed through improvements to Marathon's systems.

"Time is money. Exploration and production is a capital-intensive business that takes time, and often many projects, to establish a commercial field. If you are not there first, armed with your subsurface information provided through your technical computing environment, your competitor will be," said Marathon Seismic and System Services Senior Technical Consultant Dr. Tom R. Evans.

The data-intensive components of the workflow needed to be addressed in the context of three specific industry trends that were causing information technology concerns:

1. Competition for increasingly fewer new hydrocarbon opportunities which, together with the hydrocarbon traps which are increasingly more challenging

- to define, is a significant task for the industry today. Technology's role, enabled through state-of-the-art information technology, is to utilize emerging compute-intensive seismic imaging algorithms to illuminate the most challenging subsurface characterization problems. Given the competitive nature of the business, the work must be undertaken rapidly and to a high degree of accuracy—again pushing information technology to its limits.
2. Modern petroleum exploration and development is seeing a drastic increase in the volumes of data required for today's problems. Information technology resources capable of handling and processing several terabytes of data per project are required.
 3. Finally, the petroleum industry is faced with an acute demographic problem—its experts are aging, and increasingly it is necessary to accommodate a more virtual approach to getting the work completed. Again, from an IT perspective, systems would need to change to allow a much greater flexibility in terms of wide area access to computing resources and rapid establishment of satellite offices, without sacrificing performance, functionality or security.

An innovative thin client model was a solution devised in close cooperation with an industry-leading provider of petroleum exploration software. At the core of the proposed architecture was a group of powerful cluster-based processors that could rapidly crunch ever-growing massive amounts of information in a cost- and time-efficient manner. The thin client and high performance visualization systems were designed to be wrapped around the processing core to deliver the processed, imaged and composite data to users quickly—regardless of their locations.

With the vision established, Marathon and its technology partners planned to execute upon it. The company sought leading-edge systems architecture with high performance and reliability, at a competitive price/performance.

Solution

Marathon conducted exhaustive benchmarks and tests focused primarily on price, performance, and the ability to use a common processing architecture throughout its technical computing environment. Marathon found that the AMD Opteron™ processor could meet the company's criteria regardless of the hardware or software on which it was running. This allowed Marathon to base its foundation on AMD64 technology and

implement the most ideal set of workstations and servers to meet specific goals—even if they were from different companies.

Marathon implemented the following technologies:

- 1) The core systems were Appro clusters based on AMD Opteron processors to conduct its compute-intensive seismic processing and imaging;
- 2) AMD Opteron processor-powered HP xw9300 Workstations for its visualization desktops, thin client visualization and visualization center; and
- 3) AMD Opteron processor-based IBM® BladeCenter LS20 servers to support information delivery to thin clients.

Impact

“The AMD Opteron processor has proven to be highly complementary to our operations. For instance, we can process our seismic data up to four times faster at one-third the cost—and deal with the rapidly increasing volume of data and the complexity of problems to be solved,” said Evans. “This has directly contributed to Marathon completing successful wells, particularly in our Oklahoma program.”

The AMD Opteron processor has also provided both flexibility and security, helping Marathon to realize exceptional efficiencies through its restructured information delivery methodology. “Marathon has some technical computing software which requires Linux® while other systems only work with Microsoft® Windows®. With a thin client environment based on AMD, which is equally optimized with competing software and hardware vendors, it doesn’t matter. We can easily set individual blades to support specific operating systems as opposed to maintaining multiple desktop environments,” said Evans.

“Our infrastructure includes various technologies and AMD serves as the common denominator. AMD’s approach allowed us important freedom of choice, leveraging and incorporating multiple vendors’ hardware and software technologies into our infrastructure,” said Evans. “It is doubtful we would have been able to create such an ideal environment if the processor was proprietary or optimized for one hardware or software vendor over another.”

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About AMD

Advanced Micro Devices (NYSE: AMD) is a leading global provider of innovative processing solutions in the computing, graphics and consumer electronics markets. AMD is dedicated to driving open innovation, choice and industry growth by delivering superior customer-centric solutions that empower consumers and businesses worldwide. For more information, visit www.amd.com.

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