Lenovo & CGG: Achieving Performance Gains in Seismic Interpretation

FOR THOSE WHO DO,

NOW YOU CAN DO MORE

Mike Leach Workstation Technologist

The Problem

- Geophysicists face the task of analyzing and interpreting vast amounts of seismic data, often with limited time
- Complex algorithms are required to define 3D sub-surfaces, salt bodies, faults and canyons, this can create tedious and repetitive processes
- Traditional desktop workstations provide an excellent platform to compute and visualize data, but frequently, additional computational resources are required to simulate complex or large volumes of data

The Objective

- Benchmark specific workflows and processes with in Insight Earth®, to determine what specific new workstation technologies provide the greatest performance gains
- Utilize emerging computational and visualization technologies from NVIDIA and Intel to improve workflow performance on the desktop workstation, improving localized simulation workflows and final time to result
- Leverage the power and performance of the new line of Lenovo's ThinkStation P Series professional workstations

The Test Perameters

- "Real-World" Data 610MB
- **551x1008x1001**
- Lenovo ThinkStation P900
- 2x Intel_® Xeon _® E5-2697v3 CPUs 14C/28T(each)
- 256GB RAM Quad Channel DDR4-2133MHz
- Magma EB3600-10 Expansion Chassis

FaultAndFractureSpark: Fracture Detection Workflow



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Data Conditioning: Footprint Removal - Workflow Impact

- Load Raw Seismic Volume Create Horizon Orientation (Structural Dip) Volume Remove Coherent Noise (Footprint)
 - Parameterize footprint removal
 - Footprint Orientation, Wavelength, Time/Depth Range
 - Repeat steps 2 and 3 for each footprint orientation and each footprint wavelength
- Create Horizon Orientation Volume
- Remove Random Noise

How many iterations might this take??

Default is Statistical Filter – Median, 3x3x1

Footprint Removal - Real-world Examples

Grand Isle (GOM, US Continental Shelf), 500x500x100; Marine 1987		
1 2 3 Inlino 3 5		
4	4 Crossline	
5	Oblique 163°	5
6	Oblique 33° 5	
7	Oblique 20° 3	
8	Oblique 60°	5
9	Oblique 140°	5
10	Oblique 50° 3	
11	Oblique 123°	3





Bohai Bay (Offshore China),
500x331x1000; Marine 1990s

1, 2, 3	Crossline	5, 7, 15
4	Inline	3
5	Oblique 63°	3
6	Oblique 113°	3
7	Oblique 149°	7
8	Oblique 45°	5
9	Oblique 18°	5
10 Oblique 162°		5
11	Crossline	21
12 Oblique 130°		5

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12 Iterations of Horizon Orientation and Footprint Removal! Bohai Bay (Offshore China), 500x331x1000; Marine 1990s

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Footprint Removal GPU Performance vs. 8-core CPU baseline



I/O Optimization; Improvement Factor



Curvature AFE

Horizon Orientation Optimization; Improvement Factor



INSIGHT EARTH SAMPLE I/O



BENCHMARK IO Sustained (MB/s) Burst (MB/s)



Conclusions

- When tested against previous generation workstations, the Lenovo P900 improved raw performance by up to 15%
- Implementation of NVIDIA Tesla_® K40 and K80, as well as Quadro_® K5200, K6000 and M6000 significantly increases computation performance, thus speeding time to result.
- Utilization of Lenovo's Flex Adapter and PCI-E M.2 SSD Flex drives, offer superior performance to traditional SATA SSD technology and the ultimate price/performance for high speed storage
- The power and expandability of the Lenovo ThinkStation P900 provides an excellent platform for adding additional GPGPU, GPU and I/O resources

ThinkStation P900

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+ + Robert Layert

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POWERED BY **NVIDIA GRID**

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_____NICE

Up to 14 Storage Devices

Up to 3 NVIDIA Quadro M6000 / Tesla GPUs

	Key Specs	Supports
	CPU:	1-2x Intel [®] Xeon [®] E5 26xx v3
	Memory:	Max 2TB of DDR4-2133MHz (<i>16x DIMM Slots</i>)
	Storage:	Up to 14x Storage Devices (<i>Over 40TB Configurable</i>) 3x Separate Sub-Systems
1	Graphics:	NVIDIA Quadro [®] Kepler GPUs (1-4x GPUs Supported)

Oil & Gas / Energy Exploration Visualization & Rendering Analysis & Simulation

