Lenovo & CGG: Achieving Performance Gains in Seismic Interpretation

FOR THOSE WHO DO,

NOW YOU CAN DO MORE

Johan Steffensen

Business Leader Workstation, Nordic

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NVIDIA QUADRO

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

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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

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The Test Parameters

- “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

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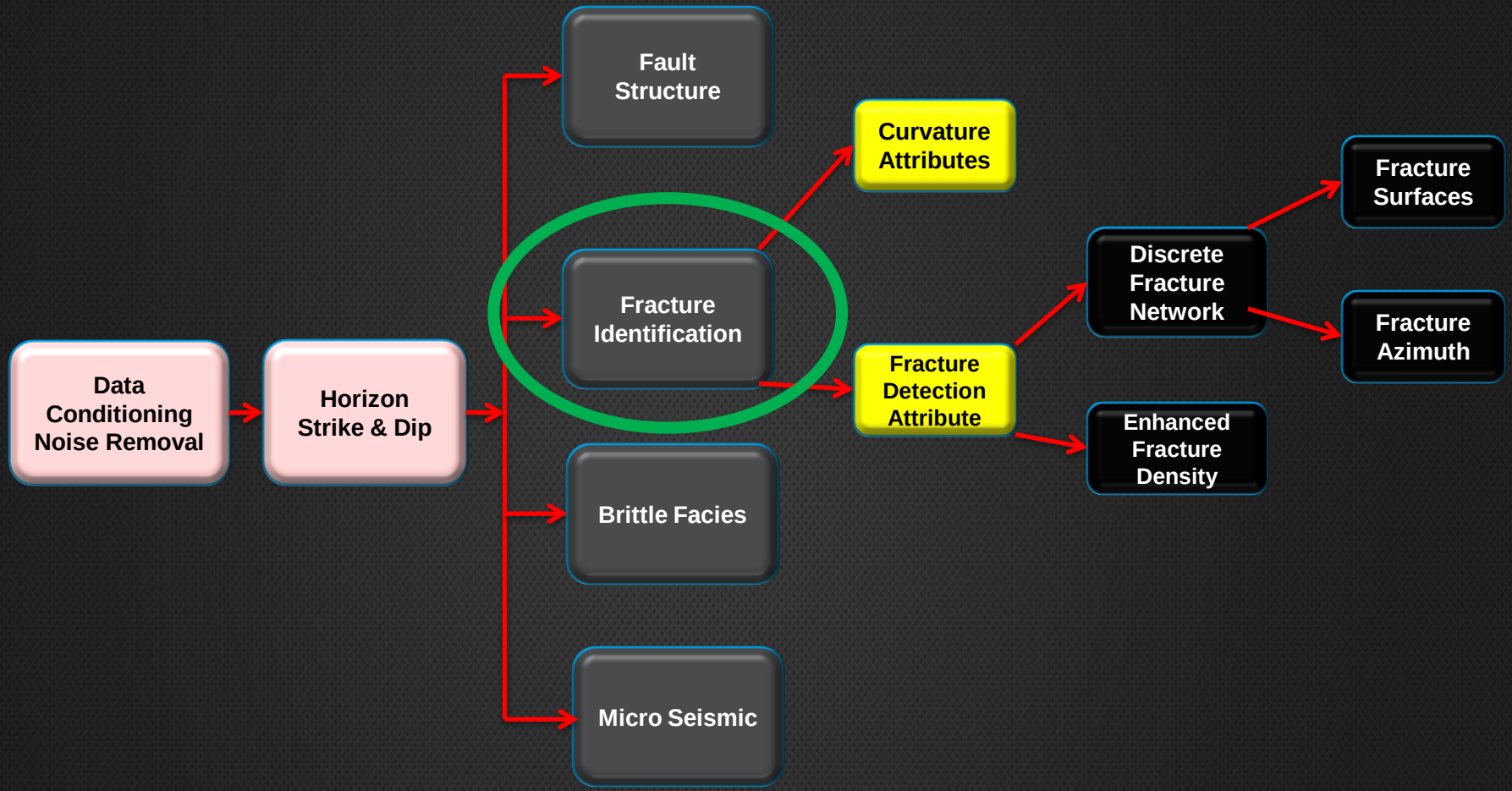
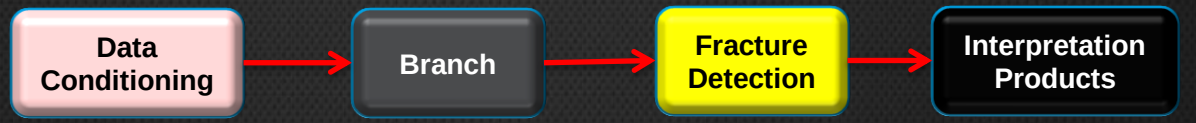
FaultAndFractureSpark: Fracture Detection Workflow



Workflow Stages



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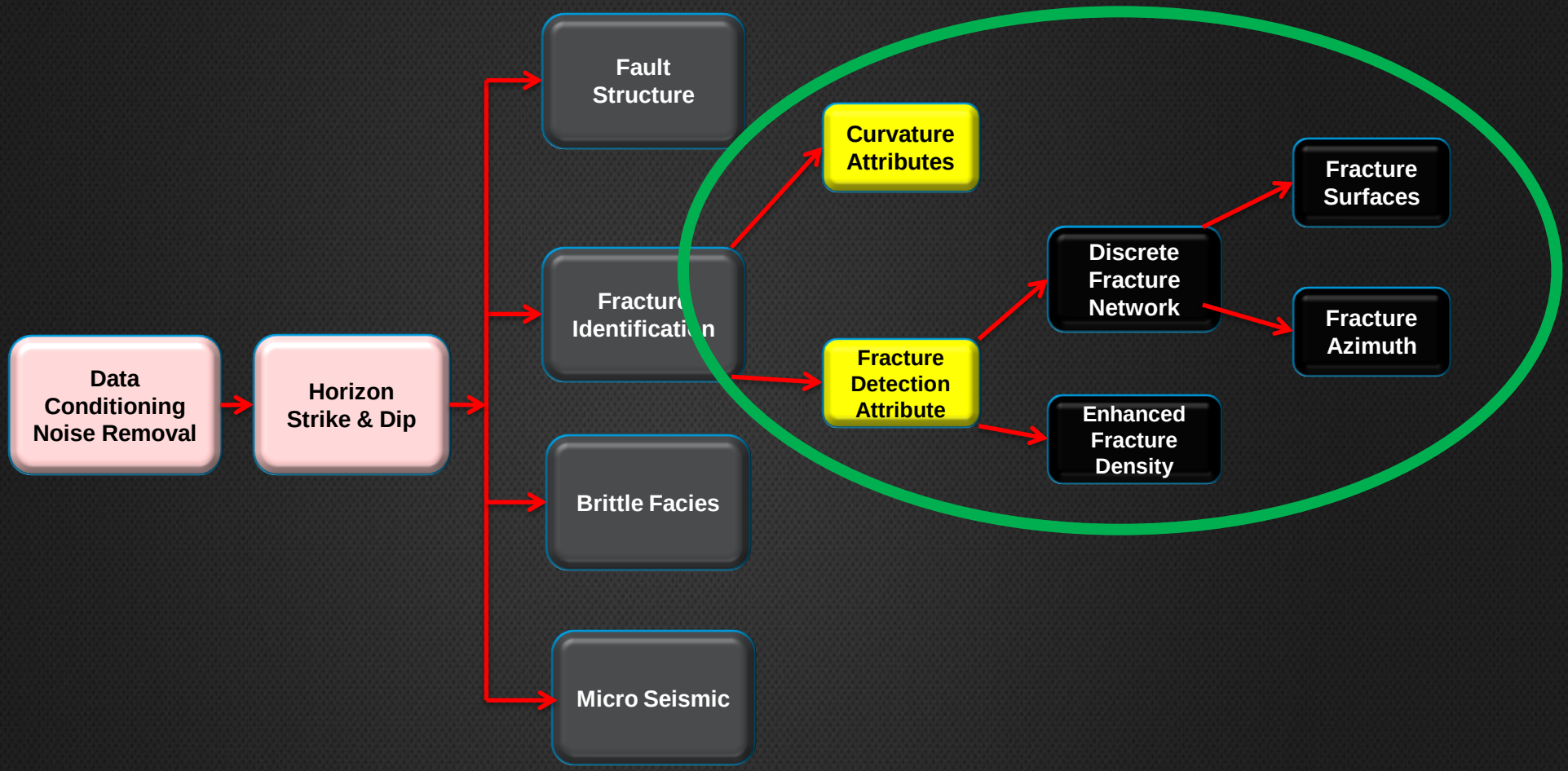


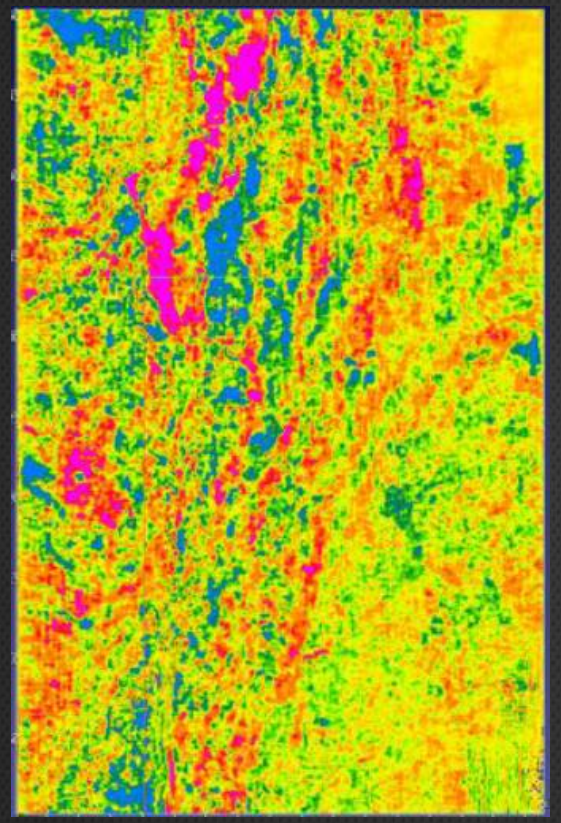
Data Conditioning: Footprint Removal - Workflow Impact

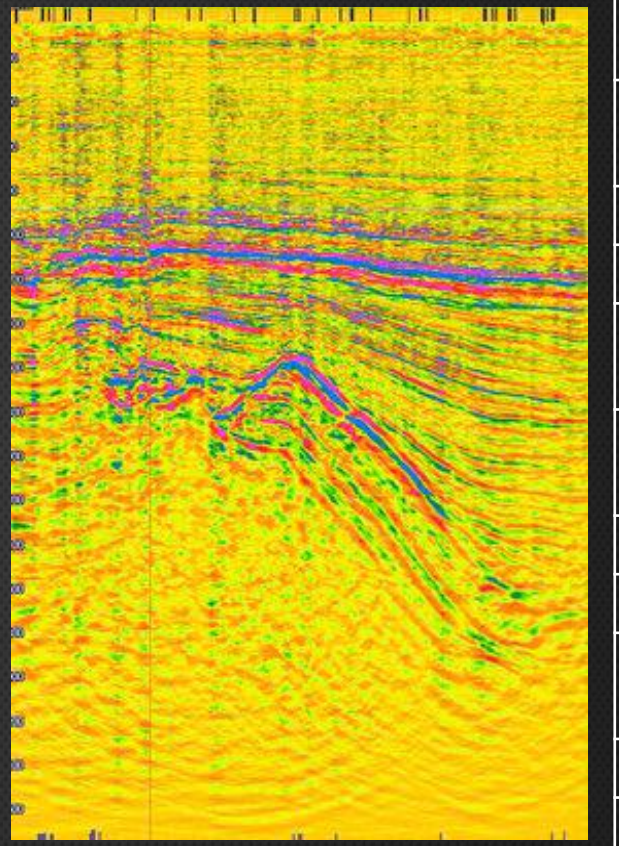
- Load Raw Seismic Volume
- Create Horizon Orientation (Structural Dip) Volume
- Remove Coherent Noise (Footprint)
  - Parameterize footprint removal
    - Footprint Orientation, Wavelength, Time/Depth Range
  - Repeat steps 2 and 3 for each footprint orientation and each footprint wavelength
- Create Horizon Orientation Volume
- Remove Random Noise
  - Default is Statistical Filter – Median, 3x3x1

How many iterations might this take??

Footprint Removal - Real-world Examples

Grand Isle (GOM, US Continental Shelf), 500x500x100; Marine 1987		
1, 2, 3	Inline	3, 5, 11
4	Crossline	3
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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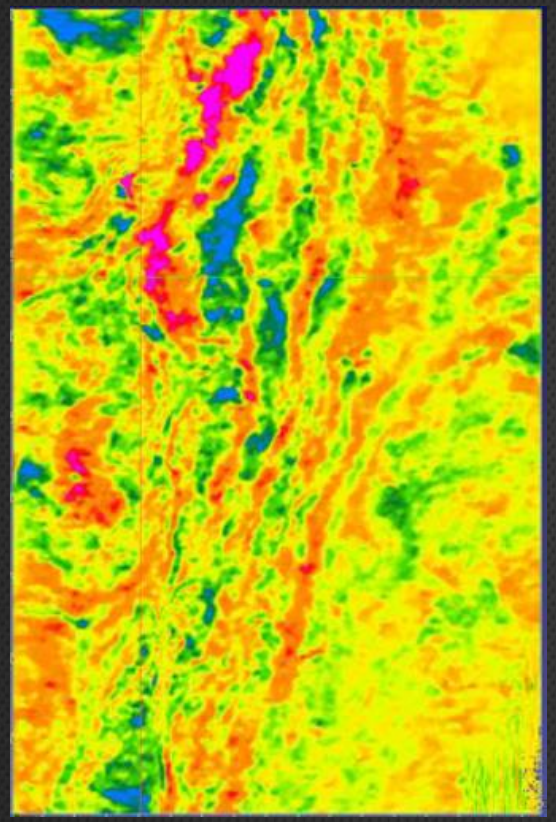

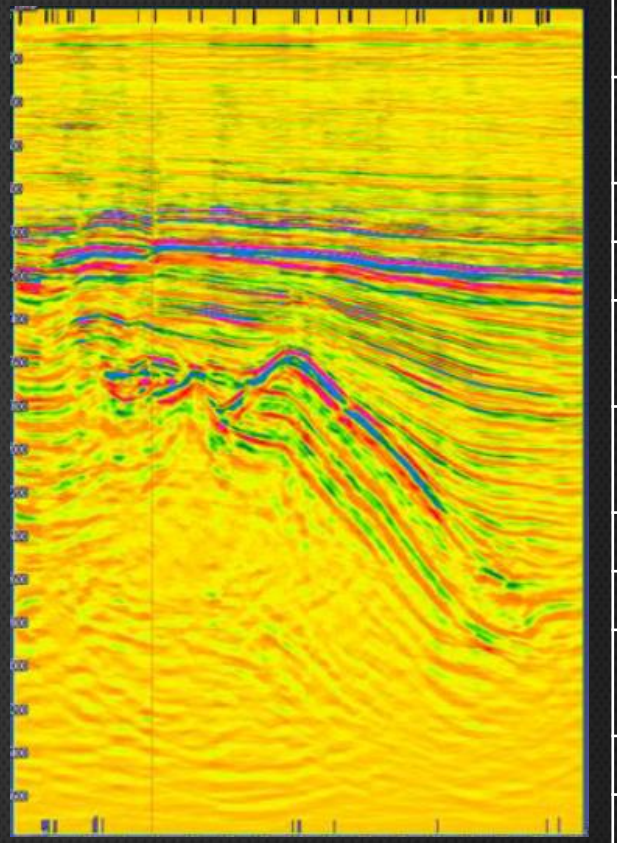

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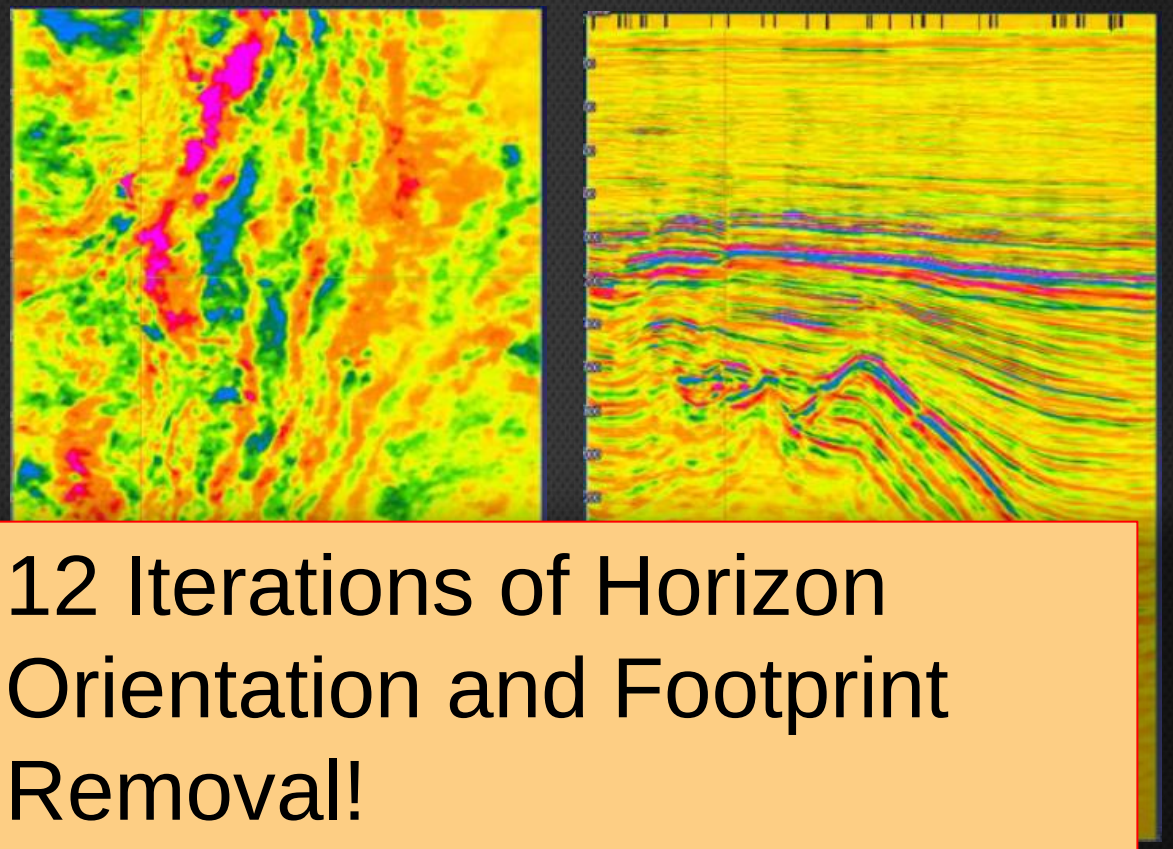

12 Iterations of Horizon Orientation and Footprint Removal!

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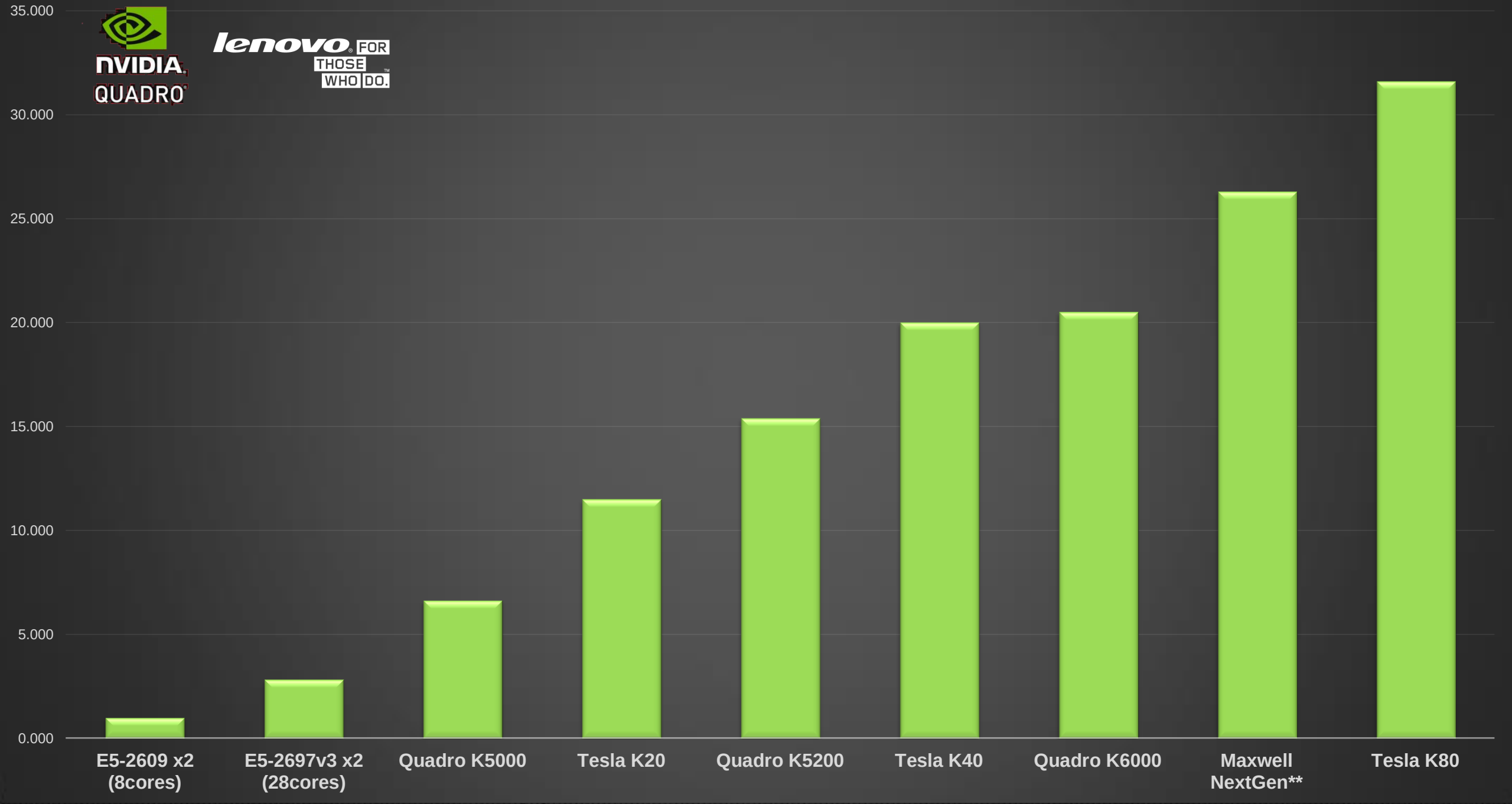
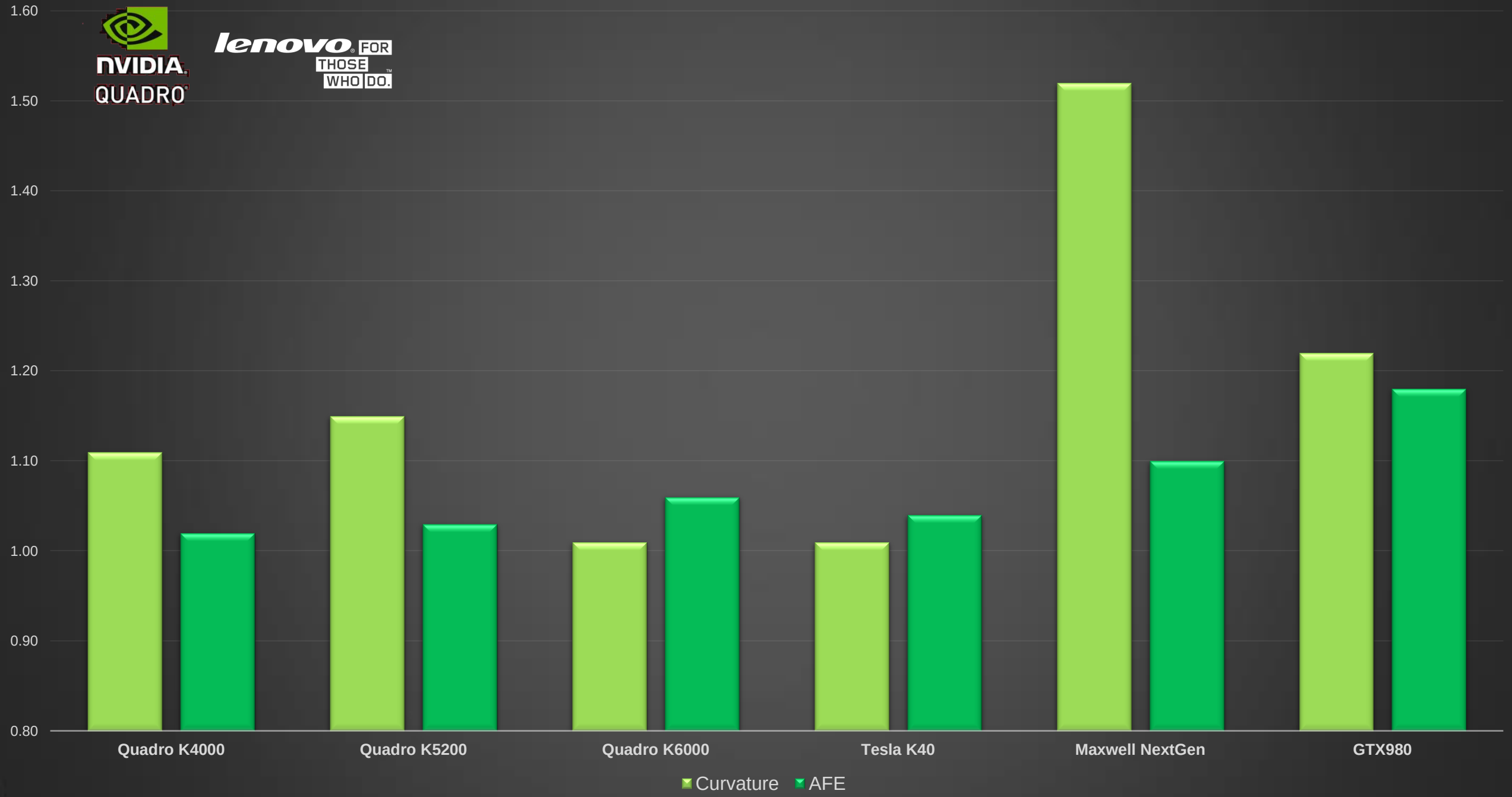
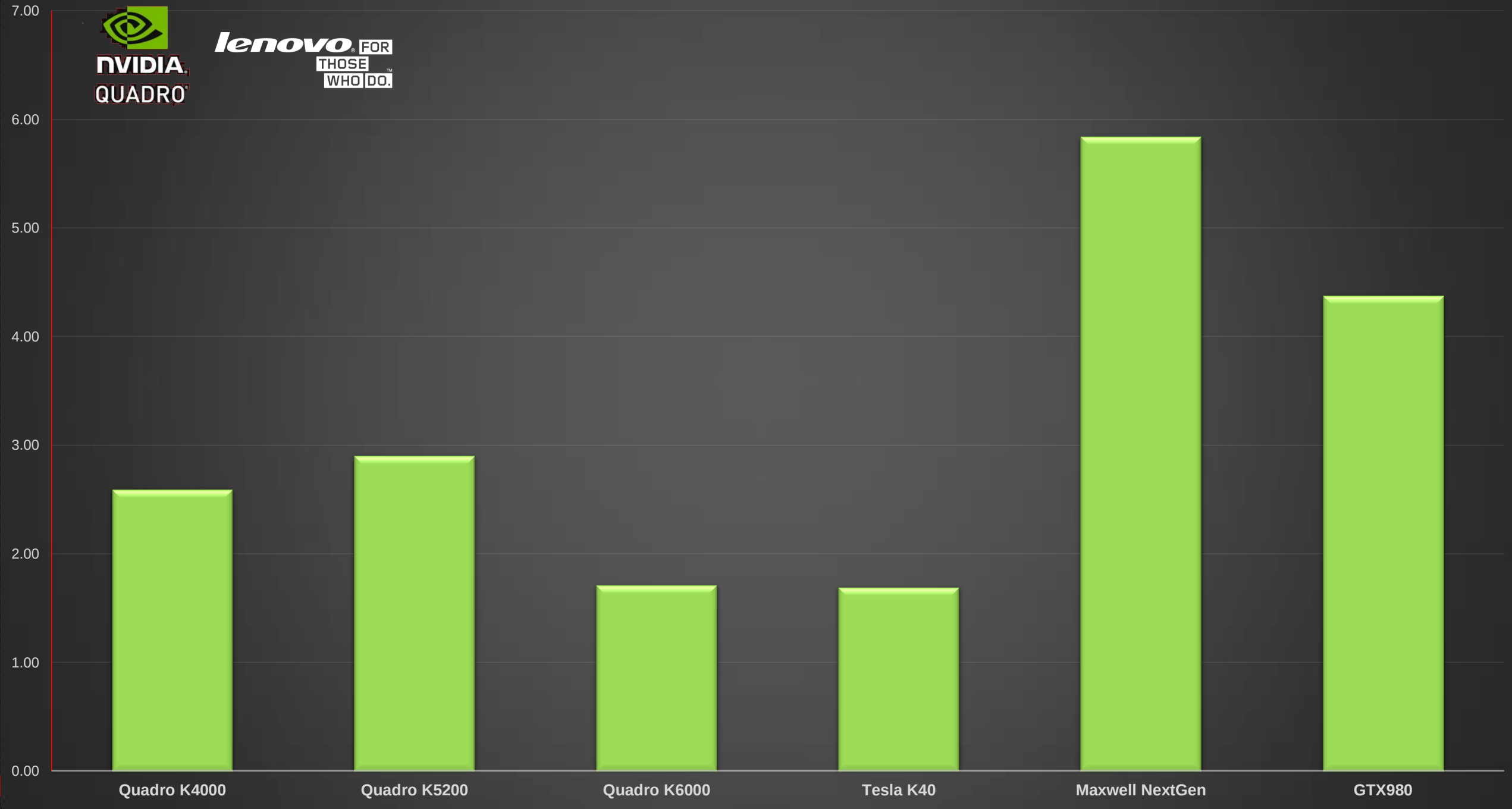
Footprint Removal GPU Performance vs. 8-core CPU baseline



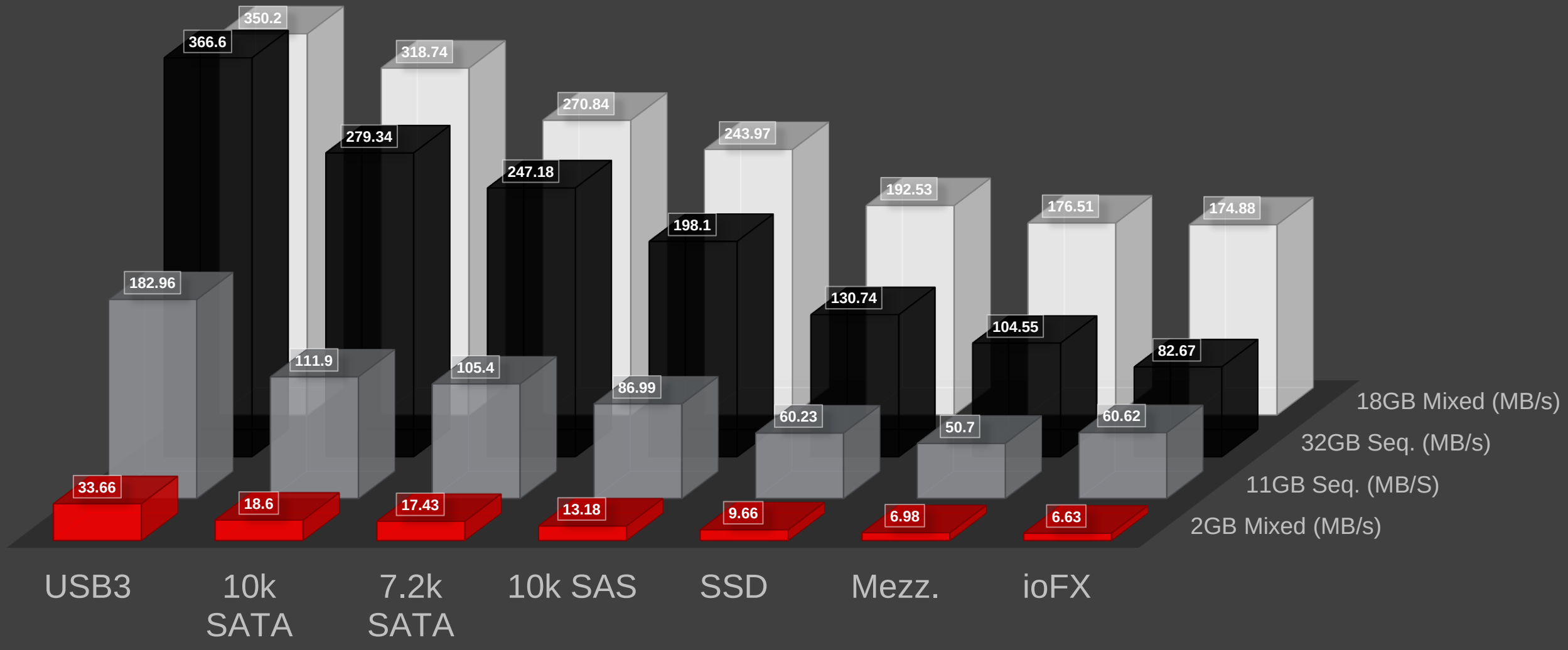
I/O Optimization: Improvement Factor



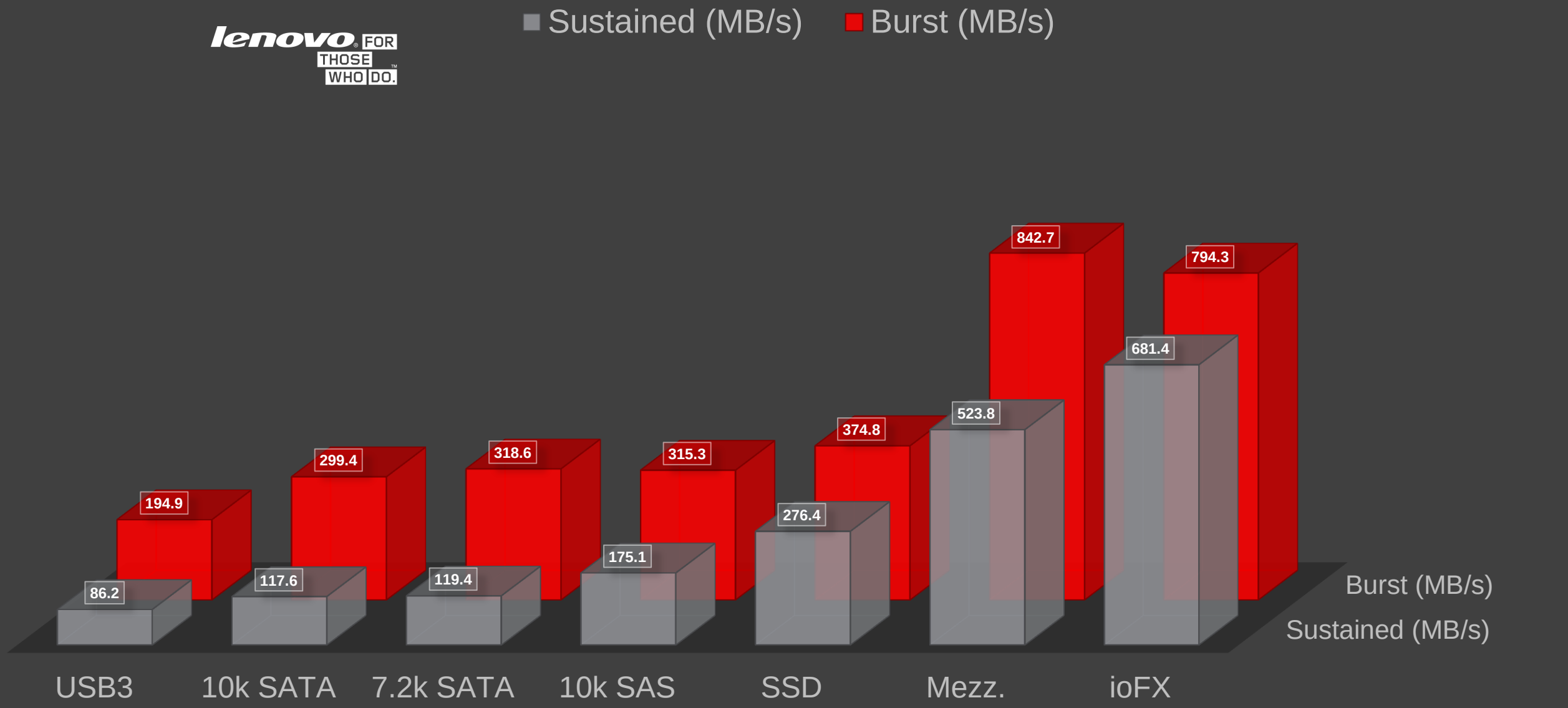
Horizon Orientation Optimization; Improvement Factor



INSIGHT EARTH SAMPLE I/O



BENCHMARK IO

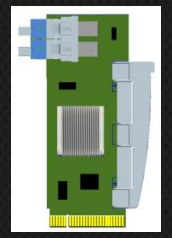


Conclusions

- 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

Lenovo ThinkStation P900

Flexible configurations empower customers



LSI SAS/SATA Flex Adapter

M.2 Adapter

Multi I/O Adapter

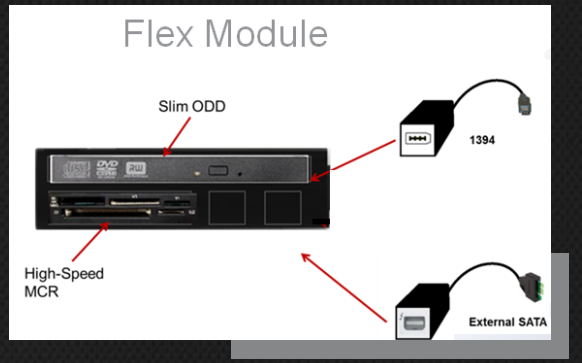
FLEX Adapters

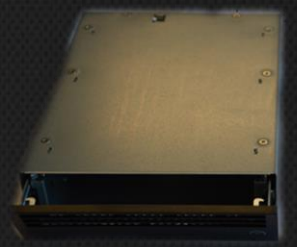
Flex Connector or mezzanine slot

FLEX Bays

FLEX Drive Trays

FLEX Power





Front Access Storage Bay

FLEX Bay Options

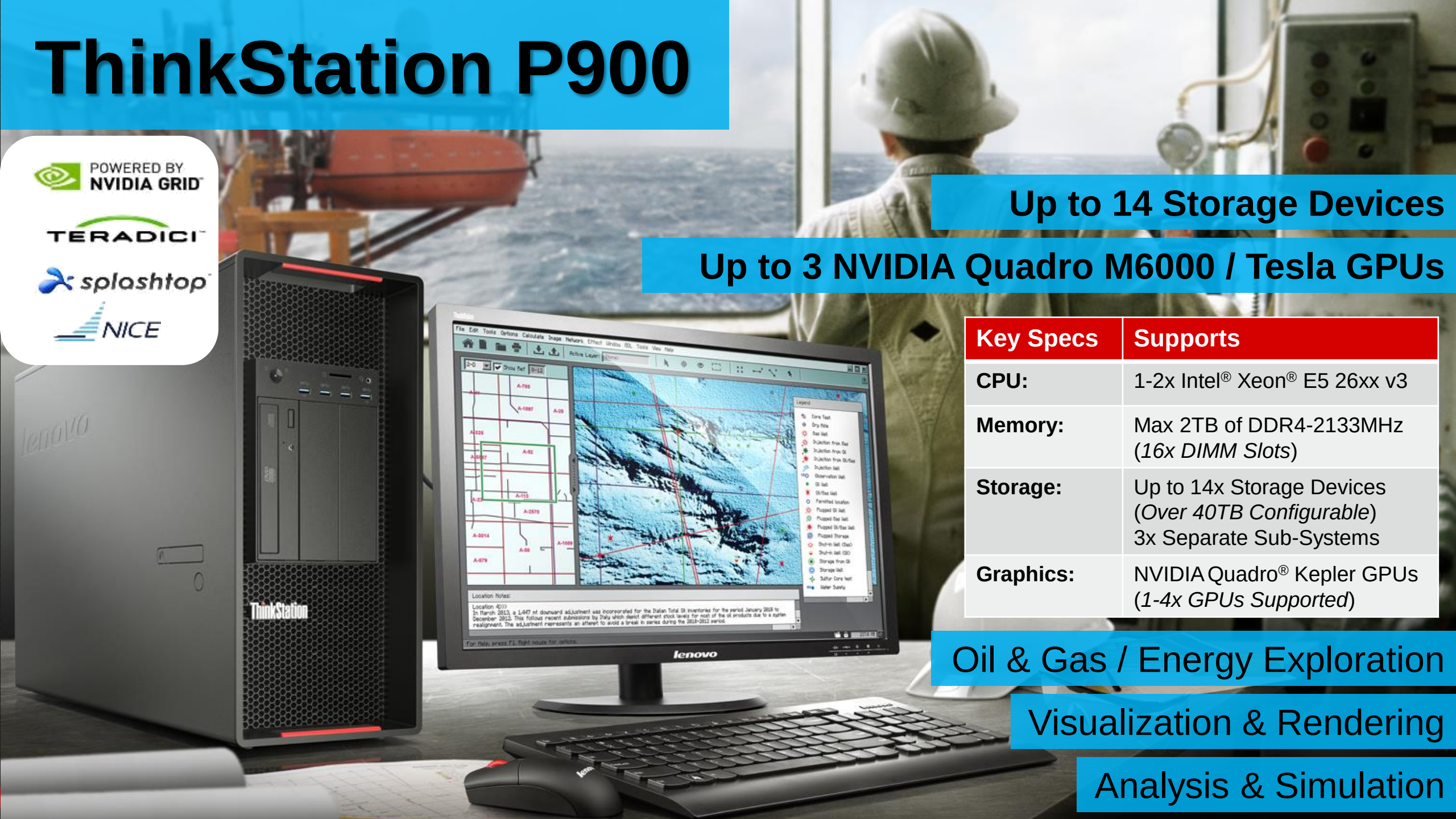
ThinkStation P900

POWERED BY NVIDIA GRID

TERADICI

splashtop

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 (*16x DIMM Slots*)
Storage:	Up to 14x Storage Devices (*Over 40TB Configurable*) 3x Separate Sub-Systems
Graphics:	NVIDIA Quadro® Kepler GPUs (*1-4x GPUs Supported*)

Oil & Gas / Energy Exploration

Visualization & Rendering

Analysis & Simulation


THANK YOU GRAZIE MERCI DANKE GRAZIAS 謝謝 СПАСИБО
GRACIAS OBRIGADO ありがとう DANK TAKK BEDANKT DAKUJEM