ACCELERATING VIRTUALIZATION IN OIL & GAS

QUICKLY ACCESS MASSIVE COMPUTE RESOURCES, SECURE DATA, AND ENHANCE COLLABORATION
With new oil and gas projects costing tens of billions of dollars, decisions about where to drill and how to maximize reservoir performance must be based on expensive and sensitive data generated by the most sophisticated modeling and simulation technology available.

Understanding the importance of protecting these valuable datasets, oil and gas firms have increasingly focused on better management and security, typically relying on remote systems to keep data backed up in local data centers. This creates long project load- and save-times and tethers geoscientists to traditional workstations or one-to-one data center workstations. Moreover, simulating and analyzing petabytes of data can be slow when real-time access is critical to success.

NVIDIA virtual GPU (vGPU) solutions help oil and gas firms overcome the challenges of processing, analyzing, and securing large datasets, as well as enable the migration of traditional workstations to the data center. With NVIDIA, firms can transform their IT infrastructure, maximize compute resources, and increase user mobility to stay agile in an intrinsically volatile industry that demands efficiency.

“NVIDIA virtual GPU technology is giving our people the performance they need to do their jobs more flexibly and effectively than ever before, and is also making it easier for us to maintain data security and overall control over our network. It’s taken us three years to get to this point, and the wait has been well worth it.”

—Corey Elliot, Director of Information Technology
Legacy Reserves

VIRTUAL GPUs FOR GREATER PRECISION AND EFFICIENCY

With NVIDIA vGPU technology, end-user devices perform as well as traditional workstations and IT management is streamlined. Leading oil and gas firms around the globe trust NVIDIA® Quadro® Virtual Data Center Workstation (Quadro vDWS) software for seismic interpretation and reservoir modeling applications, while NVIDIA GRID® software accelerates their office productivity applications and provides access anywhere, on any device.
Provide Remote Access to Secured Data
NVIDIA virtual GPU technology allows for migration of the traditional
workstation into the data center. Not only does this reduce project load- and
save-times, it also safeguards expensive and sensitive data. Geoscientists
can now access files from home, at the well site, or while traveling. And
globally dispersed teams can collaborate on files without any
performance degradation, confident that data is protected and that
they’re working on a single master file.

Speed Time to Discovery
With multi-GPU support for NVIDIA Quadro vDWS, a single virtual machine
can harness the power of up to four Tesla GPUs to boost scalability for
applications requiring heavy computation resources for data visualization.³
By speeding up and reducing model processing cycle times, NVIDIA helps
images become clearer and sharper, faster. Calculations of seismic trace
attributes and visual analysis of complex basins can now be done in real-
time, which leads to more effective lease bidding, higher service revenues,
and more efficient hydrocarbon discovery and recovery.

Minimize Downtime and Delays
In the oil and gas industry, every day of production represents millions of
dollars in investment. NVIDIA’s industry-proven stability for both Windows
and Linux drivers provides continuous uptime to minimize delays. Plus, live
migration of GPU-accelerated VMs means high system availability—IT can
perform critical services like workload leveling, infrastructure resilience,
and server software upgrades without end-user disruption or data loss.

Maximize Compute Resources
With NVIDIA, teams can utilize the same pool of virtual workstation
resources in shifts, ensuring seismic interpretation, reservoir modeling,
and engineering tasks can all be completed around the clock with no idle
resources. When additional resources are needed to power compute-
intensive processes like batch calculations, users can have instant access to
additional compute and graphics resources with Quadro Virtual Workstation
technology in the cloud.

Better Utilize the Data Center
With live migration, data center resources are always optimally distributed
to improve performance and maximize ROI. During the workday, virtual
desktops run workloads like seismic interpretation to streamline system
functionality and provide faster data for decision-making. After hours, the
same compute resources can be dedicated to completing compute-heavy
tasks like seismic processing or flow simulation.

Increase Scalability and Manageability
IT administrators can set up virtual desktops for users in geographically
dispersed locations in minutes. Rapid scaling of IT resources accelerates
production schedules, ensuring productivity is enhanced from Day One and
ongoing costs are avoided when projects are complete. Troubleshooting and
upgrades can be handled remotely.

---

³ Multi-GPU capabilities supported with NVIDIA Quadro vDWS software October 2018 release (aka vGPU 7.0)
and Red Hat Enterprise Linux 7.5 and Red Hat Virtualization 4.2 KVM hypervisors.
TESTED AND CERTIFIED FOR ENTERPRISE CLASS RELIABILITY

NVIDIA virtual GPU solutions set the industry standard for virtualized creativity. To maximize performance—and to get the best possible experience from your IT investment—NVIDIA Quadro professional graphics solutions are tested and certified by all the leading workstation OEMs and have received ISV certifications for more than 100 professional applications and IT management tools. What’s more, Quadro software drivers are designed for stability and long lifespans.

NVIDIA VIRTUAL GPU SOLUTIONS

Virtualization with NVIDIA QUADRO vDWS and Tesla GPUs

NVIDIA Quadro vDWS is ideally positioned for geoscientists and reservoir engineering teams in the oil and gas industry that work on extremely large datasets.

**BENEFITS**

- Speeds up 3D model access, response, and loading for geologists, geophysicists, and reservoir engineers
- Supports up to four 4K monitors and large frame buffer sizes for increased productivity
- Enforces data and intellectual property security in the data center
- Consolidates PLM data to enhance consistency
- Reduces downtime, even during maintenance, with GPU enabled live migration
- Centrally manages business continuity and disaster recovery
- Provides access to Quadro Virtual Workstation in the cloud, plus the option to increase resource consumption as needed
- Supports multiple Tesla GPUs in a single VM to power the most demanding workflows

**COMMON APPLICATIONS**

Schlumberger Petrel E&P and INTERSECT; Emerson Paradigm18 Geo Suite and SKUA-GOCAD; Halliburton DecisionSpace and Nexus; IHS Markit KINGDOM Suite; CGG GeoSoftware; ANSYS Fluent; Autodesk AutoCAD; Dassault Systèmes SOLIDWORKS and CATIA; and ESRI ArcGIS

Virtualization with NVIDIA GRID and Tesla GPUs

NVIDIA GRID Virtual PC (GRID vPC) and Virtual Applications (GRID vApps) are positioned for general-purpose VDI used by knowledge workers and staff in departments like finance, human resources, and marketing to accelerate workflows and provide access to trusted tools anywhere, on any device.

**BENEFITS**

- Supports increasing graphical requirements of Windows 10, modern office productivity applications, and Linux
- Supports up to four HD or two 4K monitors for increased productivity
- Enforces data and intellectual property security in the data center
- Cost-effectively rollout virtualization across your organization for as little as $2 per user per month
- Increases employee and contractor mobility
- Lowers IT management costs
- Support for Linux or Windows

**COMMON APPLICATIONS**

Microsoft Office, Skype, Adobe Creative Cloud

---

4 Assumes cost of subscription, NVIDIA GRID software, and hardware, with three-year amortization of two Tesla M10 cards supporting 87 GRID vApps users. GRID vPC for VDI starts at $4 per user per month.
CUSTOMER EXAMPLES

Legacy Reserves LP  Midland, Texas
After rolling out virtual desktop infrastructure (VDI), Legacy found that slow performance and rendering issues on applications like Spatial Energy Petra and ESRI ArcGIS prevented widespread user adoption. In response, Legacy’s IT team migrated users to virtual desktops set up on servers equipped with NVIDIA’s virtual GPU technology. When users tried the new implementation, they discovered that performance rivaled the firm’s highest-end workstations. Legacy now experiences high user adoption, enhanced data security, and simplified IT management.

Equinor  Stavanger, Norway
One of the largest oil and gas companies in the world, Equinor (formerly Statoil) deployed virtualized desktops to its exploration staff as part of an initiative to maximize efficiency across its business. NVIDIA graphics acceleration helped the firm migrate from blade servers to a fully virtualized infrastructure and run its most demanding subsurface and engineering applications from central server facilities. Today, exploration teams across 36 countries can collaborate on projects from anywhere, on any device, and the firm has realized a significant reduction in capital expenditures and operational costs.

Ouro Preto Óleo e Gás  Rio de Janeiro, Brazil
With geologists, geophysicists, cartographers, and engineers in multiple locations, Ouro Preto needed to virtualize 2D and 3D applications like Schlumberger Petrel and Halliburton Landmark to increase mobility and lower IT costs. Using NVIDIA virtual GPU technology, the firm was able to deliver graphics-intensive applications from the cloud to professionals out in the field on their computers, tablets, and even their cellphones. Ouro Preto teams now enjoy local workstation-like performance in the palm of their hands.

KEY OIL & GAS USER GROUPS

<table>
<thead>
<tr>
<th>USE CASES</th>
<th>RECOMMEND</th>
</tr>
</thead>
<tbody>
<tr>
<td>For remotely viewing and editing massive datasets and complex 2D/3D images</td>
<td>Quadro vDWS with up to four Tesla V100, P40 or P6 for blade server form factors (supports up to four 4K displays)</td>
</tr>
<tr>
<td>For remotely viewing and editing 2D and 3D mechanical images</td>
<td>NVIDIA Quadro vDWS with up to four Tesla T4, P4, or P6 for blade server form factors (supports up to four 4K displays)</td>
</tr>
<tr>
<td>For general purpose VDI, using virtualized Windows 10 or Linux desktops and common office productivity applications</td>
<td>NVIDIA GRID vPC/vApps on Tesla M10 or P6 for blade servers (supports up to four HD or two 4K displays)</td>
</tr>
</tbody>
</table>

GEOLOGISTS, GEOPHYSICISTS, RESERVOIR ENGINEERS

DRILLING ENGINEERS, CAD/CAE USERS

ACCOUNTING, MARKETING, HUMAN RESOURCES, STAFF
HOW NVIDIA VIRTUALGPUs WORK

In a VDI environment powered by NVIDIA virtual GPUs, NVIDIA virtual GPU software is installed at the virtualization layer, along with the hypervisor. This software creates virtual GPUs that let every virtual machine (VM) share the physical GPU installed on the server, or you can allocate multiple Tesla GPUs to a single VM to power more demanding workflows. The NVIDIA software includes a graphics driver for every VM. Quadro vDWS, for example, includes the powerful Quadro driver. Because work that was typically done by the CPU is offloaded to the GPU, the user has a much better experience, and demanding engineering and creative applications can now be supported in a virtualized and cloud environment.

WHAT MAKES NVIDIA VIRTUALGPUs POWERFUL

**EXCEPTIONAL USER EXPERIENCE**
Superior performance, with the ability to support both compute and graphics workloads for every vGPU

**BEST USER DENSITY**
The industry’s highest user density solution, with support for up to 32 virtual desktops per GPU, plus lower total cost of ownership (TCO) with up to 9 vGPU profiles for the most flexibility to provision resources to match your users’ needs

**CONTINUOUS INNOVATION**
Regular cadence of new software releases that ensures you stay on top of the latest features and enhancements

**PREDICTABLE PERFORMANCE**
Consistent performance with guaranteed quality of service, whether on-premises or in the cloud

**OPTIMAL MANAGEMENT AND MONITORING**
End-to-end management and monitoring that delivers real-time insight into GPU performance, as well as broad partner integrations so you can use the tools you know and love

**BROADCAST ECOSYSTEM SUPPORT**
Support for all major hypervisors and the most extensive portfolio of professional apps certifications with Quadro drivers

For more information, visit [www.nvidia.com/virtualgpu](http://www.nvidia.com/virtualgpu)