BETTER VDI UX MAKES GOOD BUSINESS SENSE

Three Ways GPUs Add Value to Your Virtualized Environment

NVIDIA

VDI USER EXPERIENCE COMES INTO FOCUS.

For years, the enterprise has optimized virtual desktop infrastructure (VDI) deployments to reduce costs and centralize IT, often at the cost of user experience (UX). But attitudes about the benefits of VDI are changing. In fact, one of the industry's biggest annual surveys[1] found that—for the first time—the top reason for deploying VDI changed in 2017. Instead of centralizing IT management, respondents are now more concerned with providing users with remote application access. And for respondents who have already implemented VDI, next to overall cost, user experience is the biggest challenge cited with VDI environments. The user experience challenges include needing to address performance in a high-latency environment, in rich media and 2D/3D graphics, and in video-conferencing solutions and the need to streamline user experience across devices. In other words, companies are beginning to recognize the true value of prioritizing users in their VDI deployments. And experts agree.

> "Through 2020, more than 80% of organizations that don't prioritize the user experience in the planning phase will fail to meet their virtual desktop infrastructure/desktop as a service deployment goals[2]."
>
> – From the Gartner report "Define and Prioritize the User Experience to Succeed with VDI and DaaS."

Today, if you want to pinpoint the number-one aspect of a VDI project that's likely to determine its ultimate success or failure, it's nailing the user experience. If the VDI environment does not allow users to be as productive as their physical PC, users simply won't want to use it. That's why it makes good business sense to design a remote desktop experience that's on par with, or even better than, a local desktop. When VDI limits mobility and worker collaboration, stifles productivity, or increases help desk tickets, any ROI gained from VDI is significantly reduced.

[1] Spruijt, Ruben, and Plettenberg, Mark. June 2017. State of the VDI and SBC Union: Survey Results 2017.
[2] Gartner. "Define and Prioritize the User Experience to Succeed with VDI and DaaS." 6 March 2017.

IMPROVING UX IS MORE CHALLENGING THAN EVER.

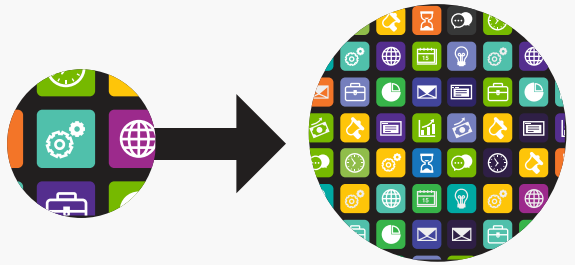
MODERN APPS ARE SLOWING DOWN LEGACY VDI.

In the modern digital workplace, one of the biggest challenges to a good VDI user experience is the evolution of everyday business applications. While once offering relatively basic functionality, modern productivity apps have evolved to provide rich, graphically intense interfaces and high levels of user interactivity. In tandem with these upgrades, the graphics requirements of operating systems have also increased. Windows 10 is a good case in point. It has the highest graphics requirement of any operating system to date.

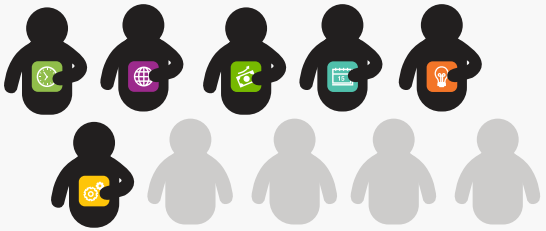
Windows 10 graphics requirements (e.g., calls to DirectX and OpenGL) have increased by 32% compared to Windows 7,[3] and the number of enterprise applications accelerated by graphics has doubled since 2012.[4]

We expect that the GPU requirements of Windows 10 will only continue to increase as Microsoft continues to evolve the operating system. Windows 10 and Office 365 ProPlus will have semi-annual feature updates, with Office 365 ProPlus having additional security and quality updates monthly. With the rising requirements for computer graphics resources, you need to make sure your infrastructure can support this.

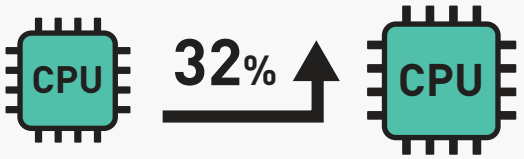
OUR WORKPLACE IS CHANGING.



2X growth in number of graphics accelerated applications since 2012[4]



>60% of enterprise employees access at least one graphics accelerated app[4]



32% more CPU is required when migrating from Windows 7 to Window 10

[3] Lakeside Software, Inc. "Elevating User Experience Through GPU Acceleration: A Windows 10 versus Windows 7 Analysis." Lakeside Software whitepaper. 2017

[4] Data from Lakeside Software's SysTrack Community, 2017

TRENDS ARE CHANGING THE WAY WE WORK.

At the same time, the enterprise is rapidly embracing video and multimedia to improve productivity and remove geographical barriers. Live-streaming meetings is now commonplace. With the rise in geographically dispersed teams, web and video conferencing software like Webex and GoToMeeting are becoming a simple and cost-effective way to collaborate online with colleagues and customers in real-time.

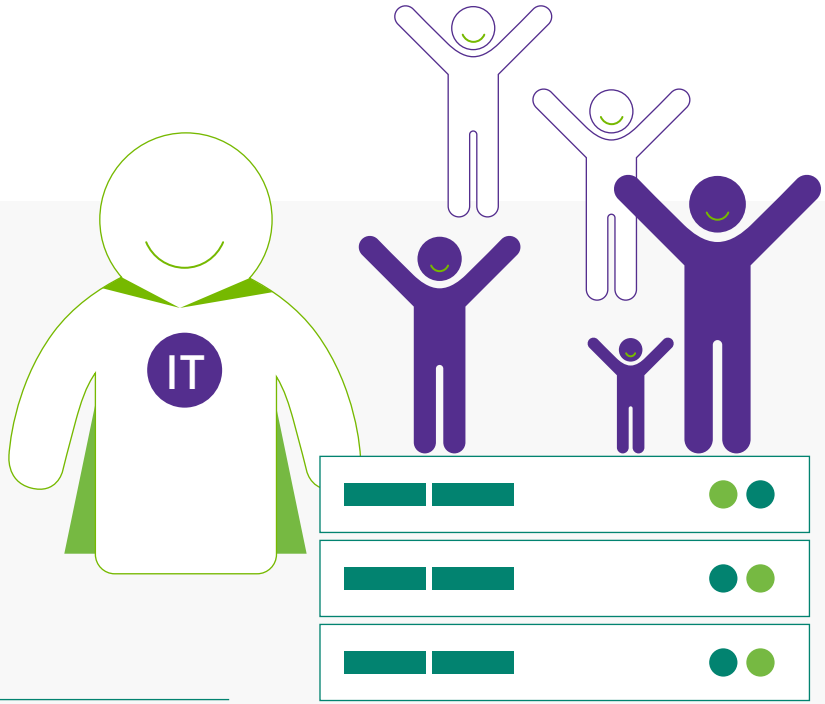
Training sales teams and onboarding new employees is frequently done with video tutorials hosted on websites like YouTube, which is now no longer just a consumer site. Plus, Skype—which started as a consumer app—is now heavily used in the enterprise as an important collaboration tool for employees working on projects across multiple sites. The distinction between these consumer, multimedia, and enterprise apps is fading as employees increasingly bring rich media types to their work environments.

GPU = HAPPY USERS + HAPPY IT

> BETTER EXPERIENCE

> IMPROVED SERVER DENSITY

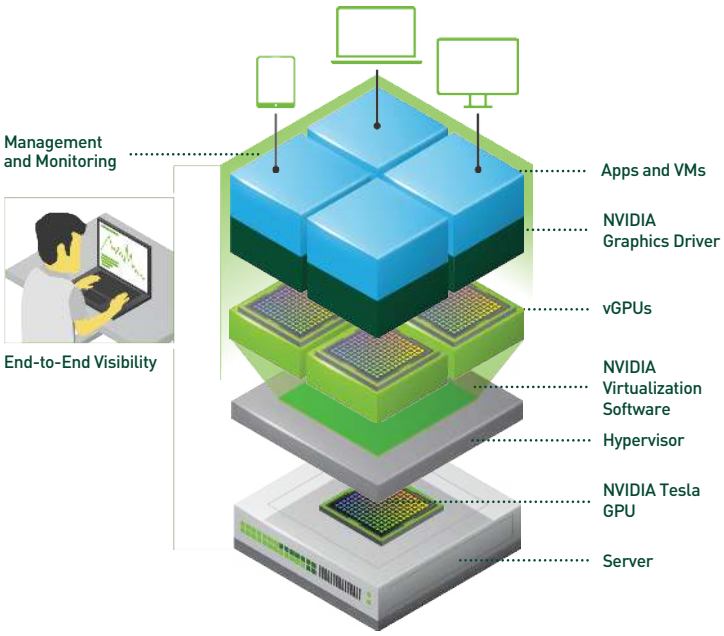
> LESS HELP DESK TICKETS



GET MODERN VDI RIGHT WITH GPUS.

Rapidly growing use of a GPU by everyday business applications pose significant challenges to virtualized environments using shared resources. With CPU resources and RAM being consumed at unprecedented rates, traditional VDI environments without a GPU delivers even slower performance and reduced feature sets. This situation only promises to get worse. A fresh perspective is needed to make today's VDI deployments successful.

While building out data centers is one way to improve VDI user experience, a more savvy approach is to look to GPU acceleration to offset added workloads. GPUs offer a cost-effective way to alleviate pressure placed on CPUs in a virtual environment and speed up VDI performance. This design results in an upgraded user experience, while also enabling servers to accommodate more users without degrading performance.



WHAT IS GPU VIRTUALIZATION?

GPU virtualization enables every virtual machine to get the benefits of a GPU, just like a physical desktop. Because work that was typically done by the CPU has been offloaded to the GPU, the user has a much better experience and more users can be supported.

If you've been wondering about the business value of adding GPUs to your VDI, consider what other enterprises have experienced firsthand. What follows are some benefits of improving user experience, as well as stories from our customers about how their businesses have benefited from GPUs.

1: GOOD UX BOOSTS USER PRODUCTIVITY.

TODAY'S WORKFORCE EXPECTS COLLABORATION AND MOBILITY.

While there are many drivers behind desktop and application virtualization, one of the biggest is the increasingly remote corporate environment. In fact, at least one day per week, more than half (53%) of employees work outside of a traditional office.[5] Today's remote workforce often logs in from anywhere, be it from home or a customer site, with the expectation that they can be as productive as their physical PC. Adding to this complexity is the new normal of bring your own device (BYOD), which has now become a fundamental requirement for today's IT departments.

Adding to this situation is the rising trend of the consumerization of technology. Employees expect a rich, immersive experience anytime, anywhere, whether they're using a smartphone, PC, tablet, or high-end workstation. The outcome is that productivity is constantly impacted. Employees get frustrated and work grinds to a halt when multiple users share server resources. All it takes is a single user with high graphics demands on a virtual desktop to slow down performance for everyone in the system.

When workers are using BYOD to not only work but also collaborate, any virtualized system is bound to struggle with increased CPU demands the minute anyone jumps on a live-streamed meeting or video. The mere perception of working collectively on a task can supercharge productivity,[6] so it's essential to ensure employees don't encounter challenges when collaborating.

[5] Dell. July 18, 2016. "Dell and Future Workforce Study Provides Key Insights into Technology Trends Shaping the Modern Global Workforce." [Press Release]

[6] Carr, Priyanka B. and Walton, Gregory M. "Cues of Working Together Fuel Intrinsic Motivation." Journal of Experimental Social Psychology, vol. 53, July 2014.

BETTER UX: MEASURE PRODUCTIVITY BY THE NUMBERS.

When you improve the basic performance of virtualized environments on a daily basis, there's a measurable business impact. Take the example of a typical knowledge worker. On average, they're clicking their mouse 1,080 times every hour.[7] During an eight-hour work day, they're likely on a computer five hours. That's five hours times 1,080 mouse clicks, or 5,400 clicks, per day.

A traditional VDI environment based on CPU adds over 400ms per click in latency[8] over a GPU-accelerated VDI environment, resulting in aggravated users and wasted time of over 40 minutes per day. Imagine getting that time back which, when added up, is over a day and a half per employee per month.

Beyond productivity savings from a GPU-enabled VDI environment, you also reap the benefits of increased employee satisfaction leading to better focus and improved quality of work. That is well worth the cost of NVIDIA GRID® Virtual PC (GRID vPC), which costs an average of $6 per user per month, and GRID Virtual Apps (GRID vApps), which costs $2 per user per month.[9]

DON'T SKIMP ON THE LAST MILE...

It costs organizations so much to hire and retain employees. In a study by Employee Benefit News, it costs employers 33%[10] of a worker's annual salary to hire a replacement if that worker leaves. With thousands of dollars already invested into your employees, why wouldn't you go that extra mile to make sure they have the tools to be happy and productive, and better contribute to your overall bottom line?

FANTASTIC USER EXPERIENCE, COST EFFECTIVE SOLUTION

NVIDIA GRID Virtual PC

As low as **$6** user per month

NVIDIA GRID Virtual Applications

As low as **$2** user per month

Assumes cost of subscription, NVIDIA GRID software, and hardware, with three-year amortization of hardware of 2 Tesla M10 cards supporting 64 GRID vPC users and 87 GRID vApps users

[7] Wellnomics Ltd. "An Analysis of Computer Use Across 95 Organizations in Europe, North America and Australasia." Wellnomics whitepaper, 2007.

[8] NVIDIA Professional Design and Visualization. "Quantifying the Impact of Virtual GPUs: See how NVIDIA benchmarks UX in VMware virtualized environments." August 2018.

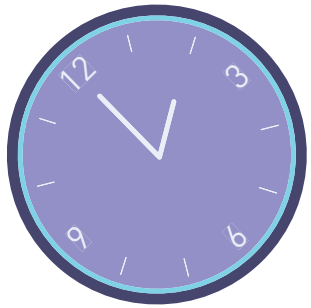
[9] Assumes cost of subscription, NVIDIA GRID software, and hardware, with three-year amortization of hardware of two Tesla M10 cards supporting 87 GRID vApps users and 64 GRID vPC users.

[10] Bolden-Barrett, Valerie. August 11, 2017. "Study: Turnover costs employers $15,000 per worker"

TECHNOLOGY IMPROVES EMPLOYEE ENGAGEMENT.

In today's workplace, innovation is key to keeping employees happy and productive, consequently allowing you to retain your best talent. A company that embraces innovation is perceived as a forward-thinking company. As more and more workers become mobile, giving your employees the right tools and resources to work virtually from anywhere is crucial. This fosters collaboration and teamwork and increases employee engagement. In fact, extensive research by Gallup has shown that...

BUSINESS UNITS IN THE TOP QUARTILE OF THEIR GLOBAL EMPLOYEE-ENGAGEMENT DATABASE ARE 17% MORE PRODUCTIVE AND 21% MORE PROFITABLE THAN THOSE IN THE BOTTOM QUARTILE.[11]



In addition, engaged employees drive better customer outcomes and customer retention, further increasing profitability. Developing and investing in employees through technology pays off in the long run.

[11] Gallup, Inc. December 19, 2017. "State of the Global Workplace 2017."

★ CUSTOMER SUCCESS

Seyfarth Shaw Leverages NVIDIA GRID to Boost User Productivity and Windows 10 Performance.

> "The biggest value NVIDIA GRID technology brings is the most native desktop experience possible... Whether our attorneys want to browse the web, scroll through large PDF files, or take advantage of video, NVIDIA GRID aids it all seamlessly."

– James Nixon, Application Support Manager, Seyfarth Shaw

SEYFARTH SHAW

Seyfarth Shaw Leverages NVIDIA GRID to Boost User Productivity and Windows 10 Performance.

INDUSTRY

Legal

CHALLENGE

Seyfarth Shaw is a global law firm with a team of 900 attorneys in 15 offices worldwide. Over the years, the firm's IT team relied on a Windows 7 VDI environment to deliver Office 10 and support lightweight document management. However, as its VDI environment aged, there were roadblocks to progress. In order to upgrade to Windows 10 and speed up web applications for users, the firm turned to NVIDIA GRID.

SOLUTION

Deployed a virtualized environment with NVIDIA GRID Virtual PC software with NVIDIA® Tesla® M10 GPU cards and Citrix XenDesktop running on Cisco UCS C240 M4 servers

RESULTS

Before	After
Poor web browsing: slow load times, sluggish video, stilted scrolling	**Native desktop experience, even on thin clients**
8–10 seconds to open up the Intranet	**2–3 seconds to open an Intranet with rich graphics**
High CPU utilization on Windows 10 virtual desktops	**~30% drop in CPU utilization with GPUs**
Numerous complaints from frustrated VDI users	**Hardly any complaints to IT**

READ THE FULL CASE STUDY »

2: GOOD UX IMPROVES ADOPTION.

NAIL THE FIRST IMPRESSION AND USERS WILL COME TO YOU.

From the outset, a virtualized environment makes sense in terms of simplifying IT and improving security. Which means CIOs and the IT department usually like VDI. However, users often feel very differently. Replacing a physical desktop with a virtual one frequently means poor performance and applications running too slowly, particularly during peak hours.

Anyone who has been involved with a VDI deployment knows the impact of user experience on adoption. **If a new or upgraded VDI deployment doesn't provide an experience that's as good as a physical workstation, users simply won't want to use it.** Reviving an environment with a bad reputation is a bigger challenge than you might think. When trying to extend virtualization across an enterprise, IT has a tough sell if word spreads about all the issues users are facing.

BETTER UX ENSURES USER BUY-IN.

When you're deploying VDI for the first time—or updating an aging environment—it's critical to deliver a high-quality user experience and validate that experience before rollout. Otherwise, your entire VDI project won't get off the ground.

Delivering a user experience that's as good as or better than an employee's current PC experience is the most important success factor when adopting VDI or desktop as a service.

Getting as many users as possible across departments to adopt VDI ensures the best ROI by helping to lower your infrastructure costs. And because GPUs take on the added workload of graphics-rich everyday applications, they aren't just for power users anymore. They're also important for today's knowledge workers and support staff.

★ CUSTOMER SUCCESS

City of Davenport Safeguards Adoption with NVIDIA GRID.

> “User adoption is key... With NVIDIA GRID, we saw that we could deliver an unparalleled user experience that rivaled the physical desktop.”

– Cory Smith, CIO, City of Davenport

City of Davenport

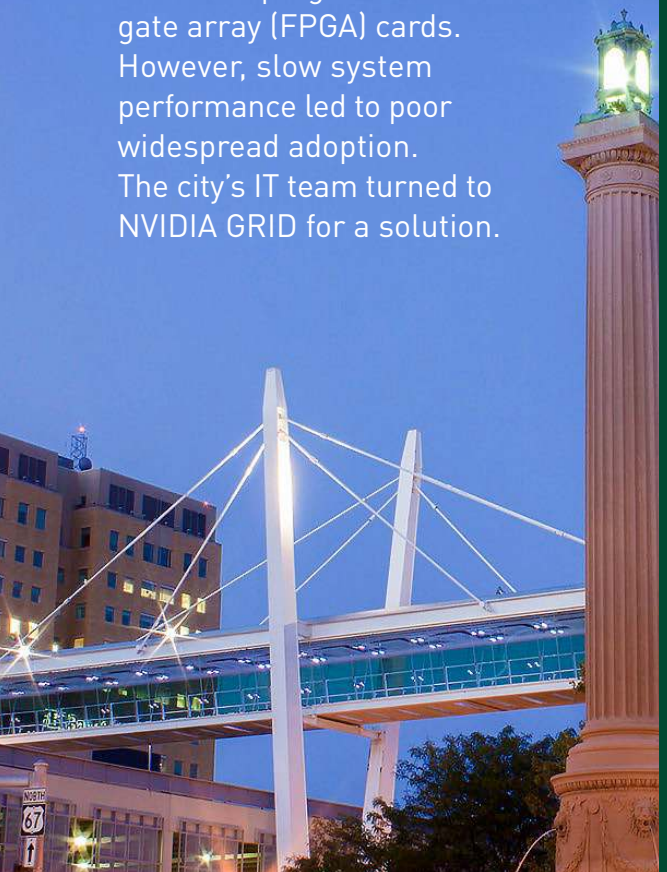
City of Davenport Safeguards Adoption with NVIDIA GRID.

INDUSTRY

Local Government

CHALLENGE

The City of Davenport is a mid-size municipality in Iowa with 1,000 employees at 34 facilities. During a cost-saving initiative, it deployed virtual desktops with field-programmable gate array (FPGA) cards. However, slow system performance led to poor widespread adoption. The city's IT team turned to NVIDIA GRID for a solution.



SOLUTION

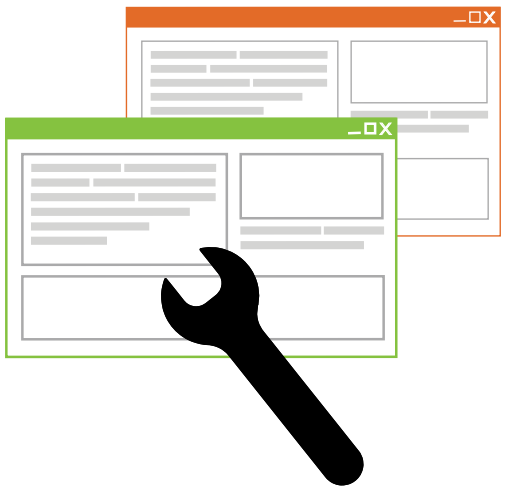
Deployed a virtual environment on NVIDIA GRID Virtual PC software and NVIDIA Tesla M10 and M6 GPU cards with HP DL380p Gen8 and Gen9 servers

RESULTS

Before	After
Poor VDI performance on streaming videos and productivity applications	**Lower latency on streaming videos for conferencing, training, and daily work**
Costly infrastructure with complex IT management	**2X increase in server density, with 75% leaner IT versus a comparable city**
Inability to support remote work	**Secure, mobile access to any application with support for BYOD**
Resistance from many users	**Widespread adoption, from police officers to city planners and engineers**

READ THE FULL CASE STUDY »

3: GOOD UX REDUCES TCO.



IT CAN FOCUS ON HIGHER-VALUE PROJECTS.

IT teams often find themselves scrambling to keep up with the everyday challenges of managing legacy desktop and application virtualized environments, like resetting, stuck sessions, and rebooting hosting servers. Logins take forever and sometimes don't connect at all. Constant system resets and application hang translate into frustrated users and IT getting stuck in the "keeping the lights on" trap. The recent growth of graphics-intensive applications and the explosion of BYOD have only compounded these challenges.

Today's IT departments are spending a significant amount of energy managing Windows 10 migrations, troubleshooting aging VDI infrastructure, and responding to user problems instigated by increased CPU workloads. While most companies switch to VDI because they're looking to cut costs, they often find that VDI's total cost of ownership (TCO) is impacted by IT personnel hours that are directly related to user problems. This situation ultimately results in significantly reduced cost savings.

In North America, the average volume in a virtualized desktop environment is 0.60 tickets per user per month.[11] For a company with 5,000 virtualized employees, for example, that translates into 3,000 tickets per month. Let's assume your organization is best in class in achieving service desk success with only 1,500 tickets. With the average cost per ticket for level 1 support at $22 and level 2 support at $62, each ticket filed or even escalated to level 2 that could have been resolved in level 1 is wasted expense. Assuming of the 1,500 tickets, 90% is level 1 support and 10% gets escalated to level 2, you're already incurring $35,000, and majority of which is probably avoidable cost.[12]

As we've mentioned before, without a GPU the CPU has to work extremely hard, which in turn means fewer users can be supported. The user experience can degrade so badly that employee calls to the help desk drastically increase. This drives up IT costs, which is compounded by the required additional investment in server hardware.

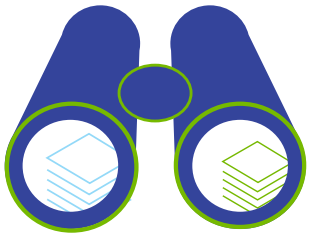
[11] Rumburg, Jeff. "The True Cost of Desktop Support: Understanding the Critical Cost Drivers of Desktop Support."
[12] Kinetic Vision. July 30, 2013. "The ROI of IT Support Improvements (Think Big)."

BETTER UX REDUCES HELP DESK TICKETS AND FREES UP IT.

When enterprise IT budgets and staff numbers remain flat, CIOs have to get creative about how to keep VDI running while also pursuing important IT projects, like data security initiatives. In order to be successful, they need to do more than keep up—they need to innovate. They need their IT personnel working on higher-value projects, instead of troubleshooting minor issues.

Rather than building out data centers to handle growing CPU demands and improve the user experience, the enterprise is increasingly turning to GPU acceleration to offset the added workloads of graphics-intensive applications. NVIDIA GRID optimizes data center architecture, taking on increased CPU workloads.

Transitioning to the high-performing platform ensures seamless performance on accelerated apps, improves server density, protects your investment, and results in happier, more productive users. **Additionally, getting end-to-end visibility into your virtualized infrastructure, down to the application level, will ensure you can right-size allocation of resources, eliminating waste while simultaneously ensuring users get the performance they need.**



When that happens, users stop wondering why things aren't working well, and they stop logging unnecessary help desk tickets. That means IT personnel get to focus on more important projects.

BONUS POINTS: GPUS INCREASE SERVER DENSITY.

Although the enterprise may be investing in additional hardware and licensing costs by implementing graphics acceleration in their VDI environment, they also lower demand on the CPU, resulting in an increased number of supported users with a better user experience. And because including GPUs in a virtualized environment increases server density, the overall cost of providing a great user experience is very affordable.

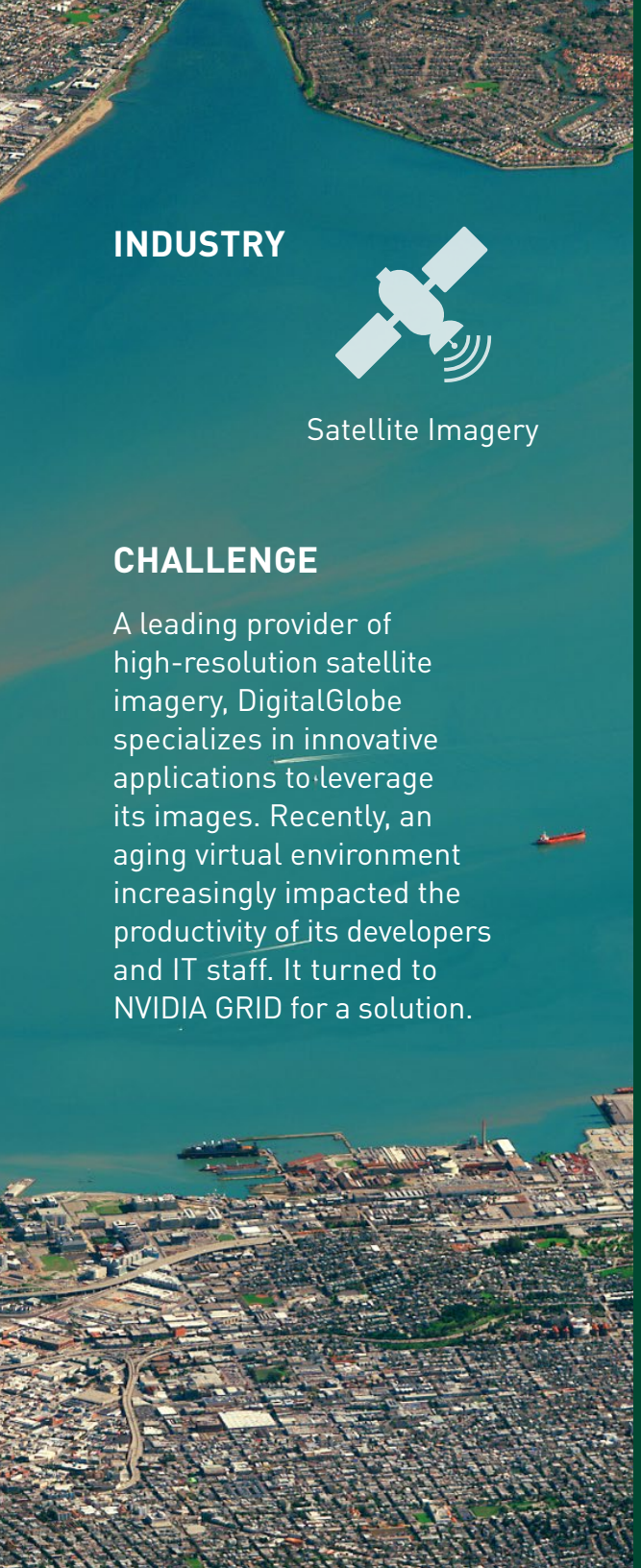
★ CUSTOMER SUCCESS

DigitalGlobe Improves IT Efficiency with Virtualized Desktops on NVIDIA GRID.

"Thanks to NVIDIA Virtual GPUs, we have a team of 3.5 people who easily manage 1,500 users daily... That's a 500-to-1 management philosophy. You don't get that anywhere."

– Mike Bantz, Engineer and Technical Lead for VDI Environments, DigitalGlobe

DigitalGlobe



DigitalGlobe Improves IT Efficiency with Virtualized Desktops on NVIDIA GRID.

INDUSTRY

Satellite Imagery

CHALLENGE

A leading provider of high-resolution satellite imagery, DigitalGlobe specializes in innovative applications to leverage its images. Recently, an aging virtual environment increasingly impacted the productivity of its developers and IT staff. It turned to NVIDIA GRID for a solution.

SOLUTION

Deployed a virtual environment with NVIDIA GRID Virtual PC and Virtual Apps software with NVIDIA Tesla M10 GPU cards on Nutanix 3350 and Dell PowerEdge R720 and R730 servers

RESULTS

Before	After
Slow VDI performance on web and graphics-intensive applications	**Consistently great experience on any device**
Constant troubleshooting and lack of visibility into users' resource requirements	**3.5 IT people easily managing 1,500 users daily**
Overprovisioned VDI environment	**Optimized allocation of resources, along with 2X improvement in user density**
Poor VDI adoption	**Stellar adoption, with everyone wanting to be moved over to the new VDI environment and IT unable to keep up with the requests**

READ THE FULL CASE STUDY »

WHAT DEFINES GOOD UX?

IT ISN'T PERSONAL OPINIONS OR SIMPLE FORMULAS.

It's broadly agreed that the success of a VDI deployment is measured by the degree to which VDI end users feel that they're working on a local desktop or PC. The problem with validating user experience has always been: How do you quantify something that's seems so subjective?

Until recently, the best you could do was approximate by using a legacy benchmarking tool. The idea was that you could measure the average application response time inside a guest operating system of a VDI instance to get a good understanding of what users were experiencing.

Recently, all that changed when NVIDIA developed a benchmarking tool. Based on a unique methodology, it models and automates the various behaviors in a typical knowledge worker's daily routine, including:

- End-user latency
- Image quality
- Consistency of end-user latency
- Remoted frames
- Server utilization

VDI deployments also aim to achieve the best possible user density on server hardware. However, as user density is scaled up after a certain point, the user experience is negatively impacted.

NVIDIA's benchmarking tool measures these trade-offs by modeling how knowledge workers use applications and what happens to performance when workloads are run at scale.

REALIZE THE DREAM OF VALIDATING GREAT UX.

GPU IMPACT IS TOTALLY QUANTIFIABLE BEFORE ROLLOUT.

Wouldn't it be great to understand the impact of GPUs on virtualized environments, so you can be confident you're building VDI that delivers the best possible user experience? NVIDIA's unique user-experience benchmarking tool can help.

Now you can achieve better user experience on your graphically intensive VDI environments and support up to 33% more users on your server.

READ THE WHITE PAPER
for more information.

WWW.NVIDIA.COM/GRID