



# WHAT'S NEW WITH NVIDIA VIRTUAL GPU

John Fanelli, Vice President of Product

Anne Hecht, Senior Director of Marketing

# EVOLUTION OF GPU ACCELERATED VDI

Designers,  
Architects,  
Engineers



2013

Business User



2016

Simulation,  
Photo Realism



2017

Live Migration



2018

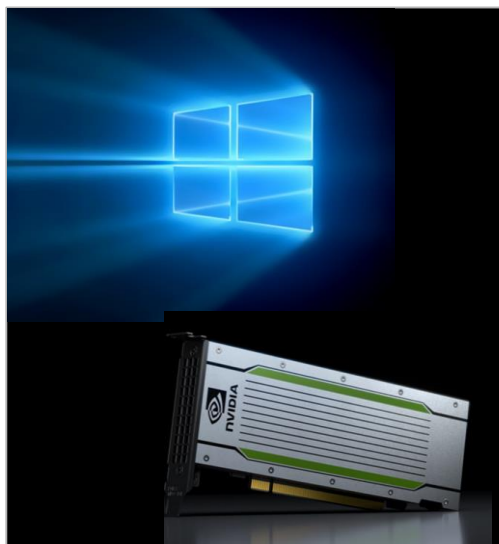
RTX Ray-Tracing



2019

# VIRTUAL GPU MARCH 2019 (8.0)

## For Every Workload



Windows 10 Migration  
Acceleration Program  
T4 with NVIDIA GRID



RTX Server for Rendering  
Quadro Virtual Data Center  
Workstations



RTX Server for Gaming  
NVIDIA GRID vGaming



Quadro in the Cloud  
Global CSP Adoption

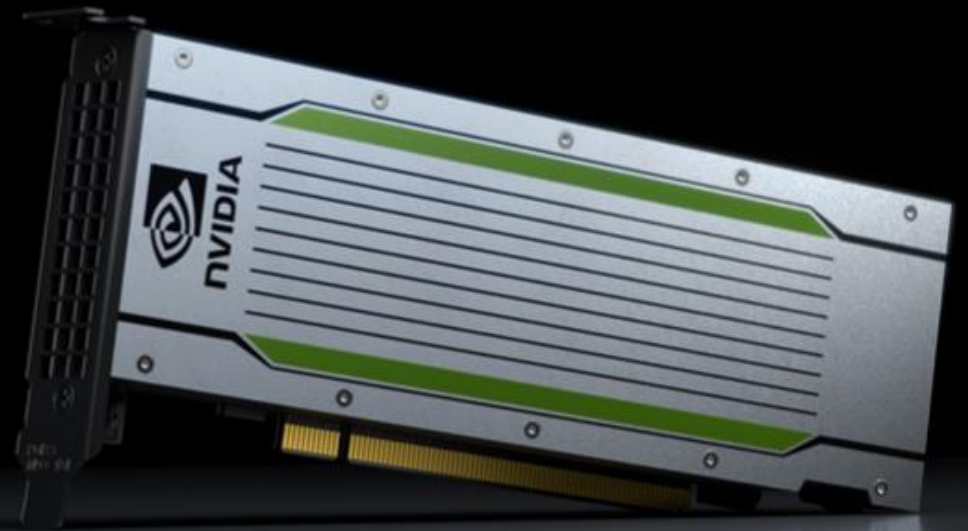


**NVIDIA GRID FOR THE  
MODERN DIGITAL WORKER**

# NVIDIA T4 FOR VIRTUAL WORKSTATIONS

Universal GPU for Everyone

- **Virtual PCs for the Knowledge Worker**
  - NEW Windows 10 Migration Acceleration Program
  - Up to 33% improved performance compared to CPU-only VMs



# CUSTOMER RESULTS

## Increased Productivity - Lower Management Costs - User Satisfaction



- Where it used to take 8-10 seconds to open up the intranet, it only took **2-3 seconds** with GPUs - SeyFarth Shaw



- Achieved **75% leaner IT** with simplified management, compared to a city with the same population - City of Davenport



- **500:1** IT to employee ratio - DigitalGlobe



- Migrated to Windows 10 and NVIDIA GRID vPC and **doubled the density** at 2/3s the cost - The Polyclinic



- VDI that performs so well that they don't hear from users - Häagen-Dazs Japan



- Same day dental implants - Touro Dental College



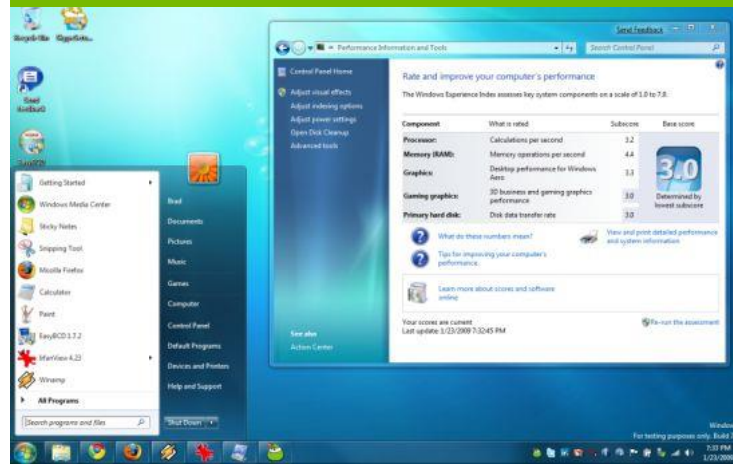
# WINDOWS 10

Highest Graphics Requirement of any Operating System to Date

## WINDOWS XP



## WINDOWS 7



## WINDOWS 10



Windows 10 Requires a 50% Increase in graphics requirements, compared to Windows 7



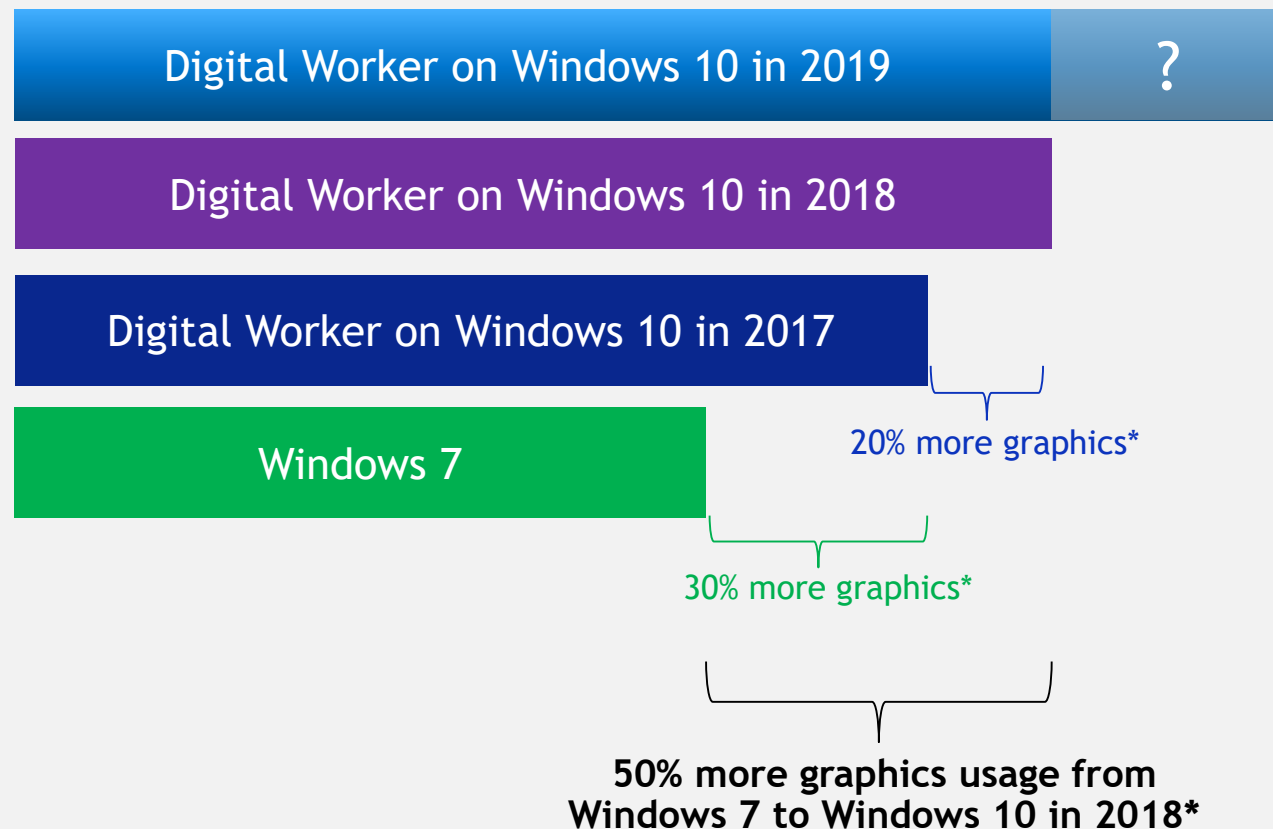
# INCREASING DEMAND FOR GRAPHICS

Windows 10 was developed with hardware acceleration in mind and is fully accelerated using a GPU by default

Certain features like Metro/Modern UI cannot be completely disabled

Free Windows 10 upgrades for consumers drive expectations for the same quality of experience at work to be productive

## GRAPHICS USAGE OF WINDOWS ENVIRONMENTS

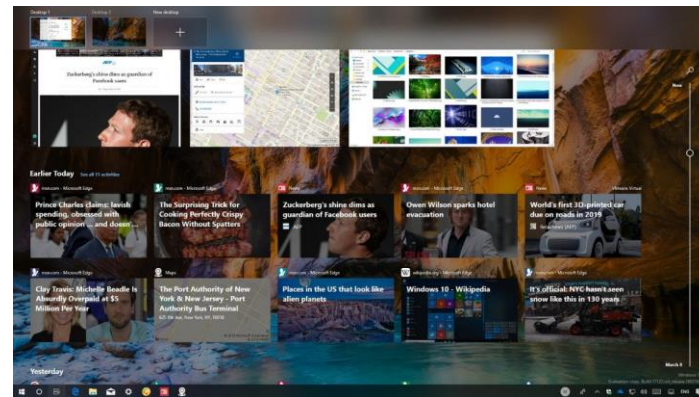


# WINDOWS 10 BUILDS GET MORE MASSIVE



Windows 10 in 2017\*

32% increase in graphics requirements from Win7



Windows 10 in 2018\*

50% increase in graphics requirements from Win7

- More 3D features (Snipping Tool, Timeline)
- Set customized graphics performance by application
- Fluent design UI including new “acrylic” texturing
- Motion improvements bring super smooth animations to dropdown menus, opening a new tab and more

20% increase in graphics requirements in Windows 10 from 2017 to 2018

3X increase in graphics requirements from Office 2010 to 2016

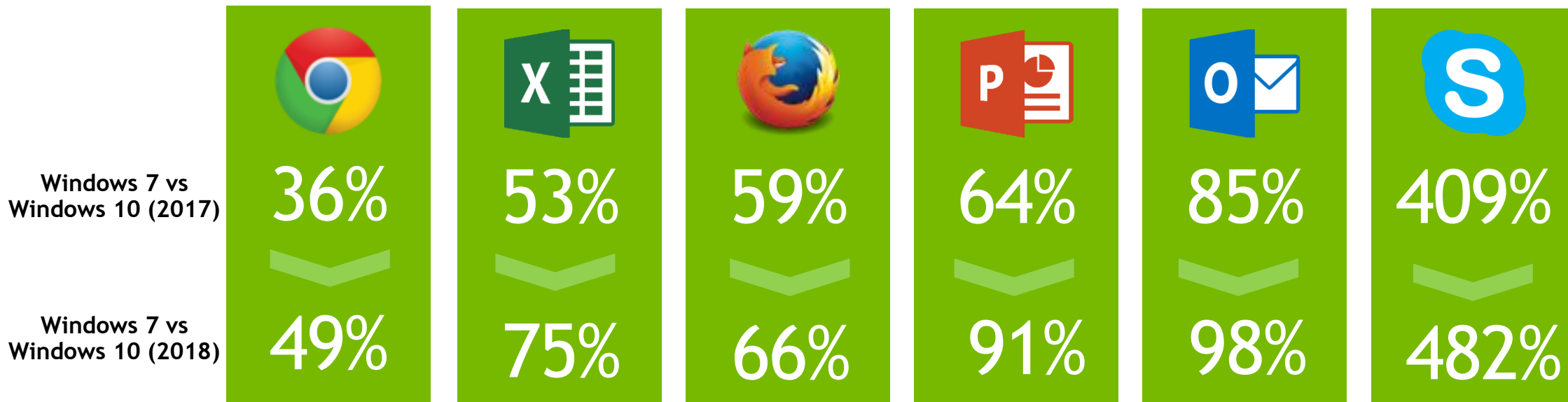
# Windows 10 Continues to Evolve

As new updates to Windows 10 aim to bring more and more 3D and 4D capabilities to base OSs, as well as everyday business applications such as Microsoft PowerPoint, the need for IT organizations to leverage virtual client computing with support for GPUs to deliver a superior virtual graphics experience to any device, anytime, anywhere will continue to grow exponentially.



# MODERN APPS IN THE DIGITAL WORKPLACE

Demands More Graphics

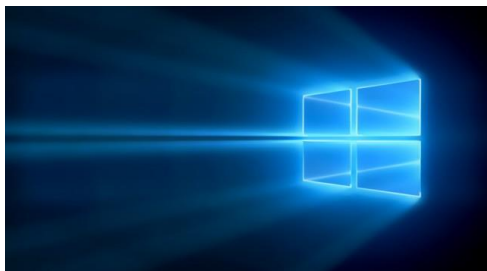


Applications that require graphics has doubled since 2012

Over half of enterprise users access at least one graphics accelerated app

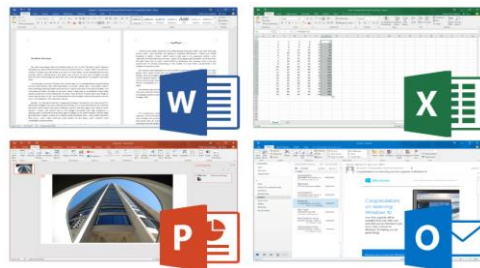
# THE NEW DIGITAL WORKER

## The Way We Work is Changing



Windows 10

50% increase in GPU requirement over Windows 7<sup>1</sup>



Office 365/Office 2016

50-100% increase in GPU requirements over Windows 7<sup>1</sup>



Web Browsers

Modern browsers are hardware accelerated by default



Latest Web Standards

Flash, HTML5, and WebGL are all very taxing to the CPU



PDF Viewers

Adobe® Acrobat® and Microsoft Edge are hardware accelerated by default



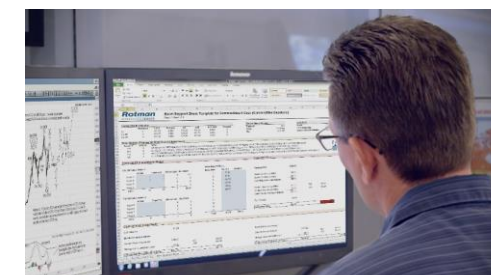
Collaboration and Video

Skype and YouTube are now prevalent across the enterprise



Digital Imaging & Design

Some features in Adobe® Photoshop® won't work without a GPU<sup>2</sup>



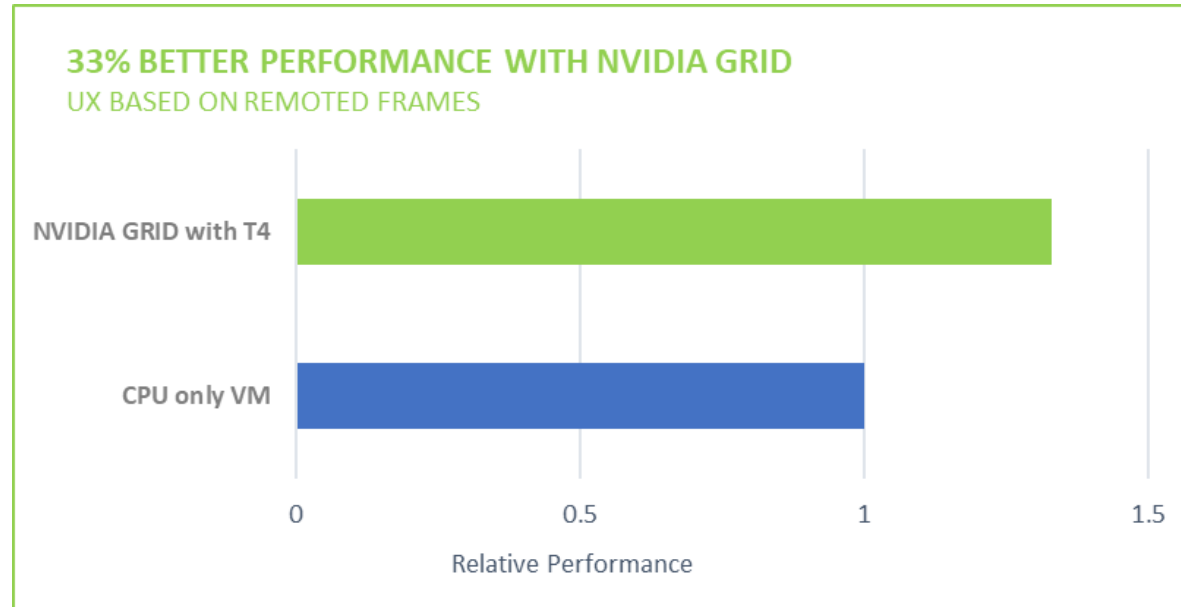
Multi-, High Res Monitors

Multi-monitors is the new normal and 4K is becoming mainstream

<sup>1</sup> Percent of time consuming GPU (DirectX or OpenGL), comparing Windows 7 to Windows 10 builds in 2018 (builds 1803 and 1709)

<sup>2</sup> Adobe. December 31, 2017. [Photoshop Graphics Processor \(GPU\) Card FAQ](#).

# NVIDIA GRID vPC FOR THE BEST WINDOWS 10 VDI USER EXPERIENCE



Tested by NVIDIA on knowledge worker workloads (Excel, Word, PowerPoint, Chrome, Media Player, PDF) running on a single HD-resolution display with NVIDIA GRID 7.1 and NVIDIA T4-1B

# WINDOWS 10 MIGRATION ACCELERATION PROGRAM

SERVER + GPUS + SOFTWARE (90 day activation delay) + Support

Certified Bundles - Validated & Tested

**T4**

Universal GPU high utilization

GRID vPC (64 users) + Four T4  
GRID vPC (96 users) + Six T4

**M10**

Lowest cost per user

GRID vPC (64 users) + Two M10  
GRID vPC (96 users) + Three M10

**GRID vPC Software**

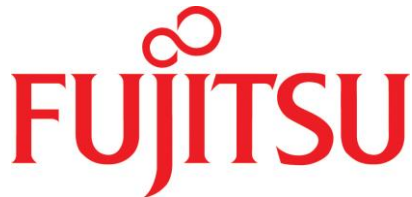
33% off on 3 year subscription (3 years for price of 2)

40% off on 5 year subscription (5 years for price of 3)

# WINDOWS 10 MIGRATION ACCELERATION PROGRAM

Broad Partner Adoption

Available





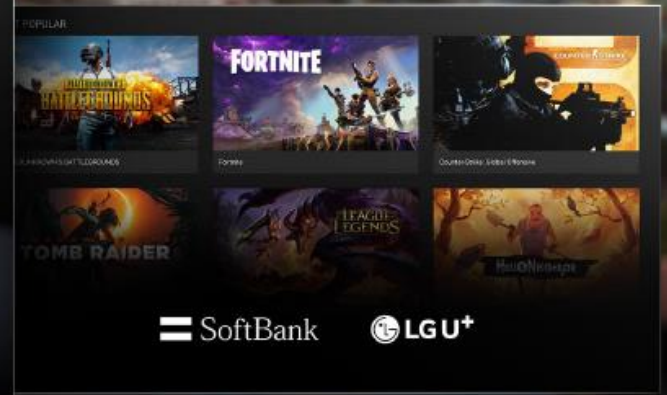


**NVIDIA RTX SERVER  
WITH QUADRO vDWS**

# RTX SERVER

Accelerated GPU Rendering in the Data Center

RTX | OMNIVERSE | 5G GFN ALLIANCES



# RTX SERVER - RENDERING

Accelerated GPU Rendering in the Data Center



NVIDIA RTX SERVER



# EXPLOSION OF CONTENT

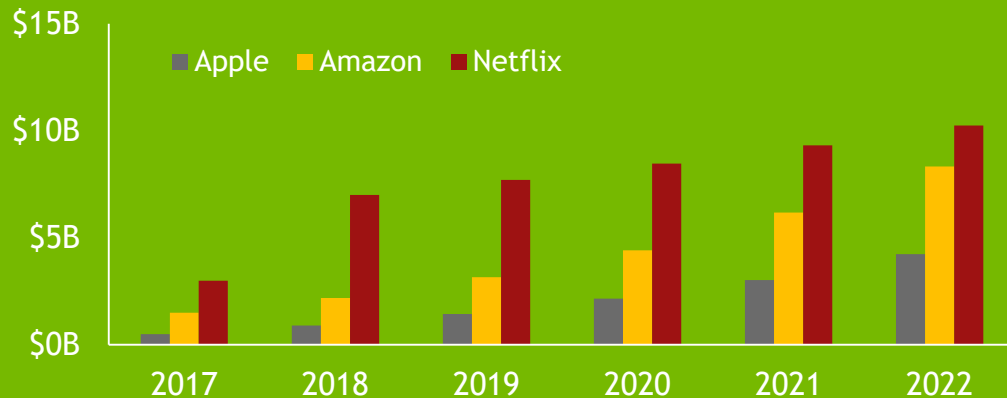


63 VFX Shots



2,680 VFX Shots

## Annual Spend on Original Content

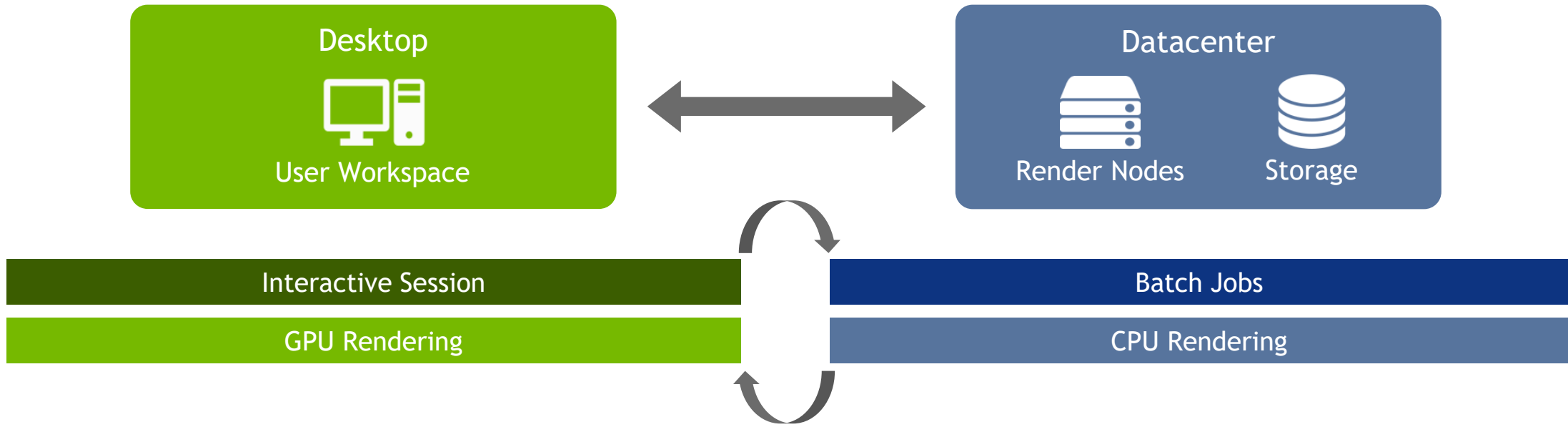


# RISING QUALITY BAR



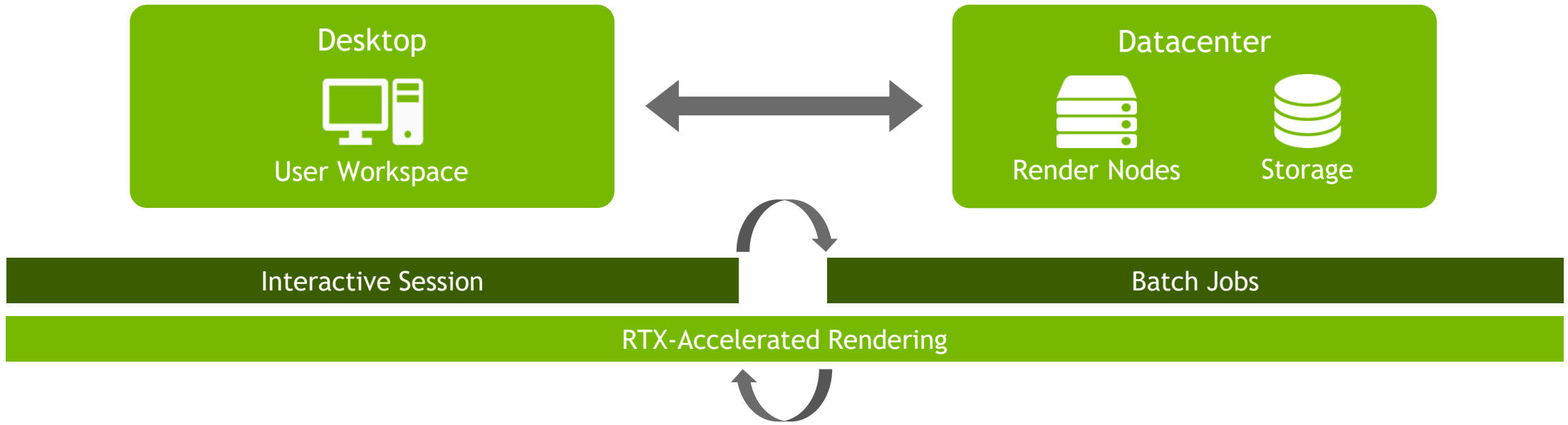
“That shot... took 400 hours a frame to render.”

*Danielle Feinberg  
Director of Photography, Lighting*



Total Install Base: >50M desktops

1.5M CPU-Based Servers



2 Shots a Day



7 Shots a Day

“We never expected to see results this dramatic. This will completely change how our artists work.”

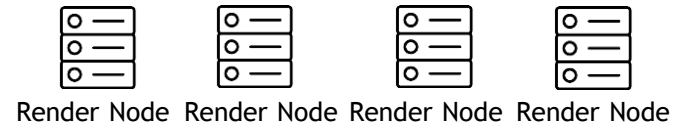
*Michele Sciolette*  
CTO, Cinesite

# ON DEMAND, INTERACTIVE RENDERING

Extend Power of RTX to Quadro Virtual Workstations



On-demand,  
Interactive,  
Rendering



Batch  
Rendering



# Datacenter



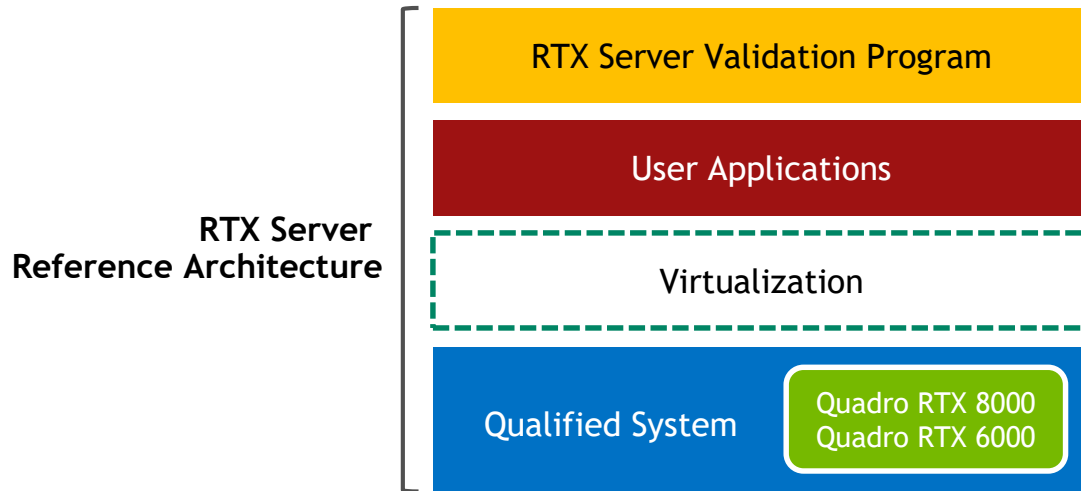
Virtualized Workspace & Rendering on RTX Server



Storage

Interactive Sessions & Batch Jobs

RTX-Accelerated Rendering





# QUADRO VIRTUAL WORKSTATION STREAMS FROM RTX SERVER

Interactive, Real Time Rendering on Any Device, Anywhere

## NEW Quadro virtual Data Center Workstation (Release March 2019):

- RTX 6000 and RTX 8000
- Up to 1.4X graphics performance than P40
- RTX Server with Virtual Workstation



# QUADRO VIRTUAL WORKSTATION STREAMS FROM RTX SERVER

“ *Any VFX firm that’s not using virtual workstations is underutilizing its workstations, leading to higher costs. Teradici Cloud Access Software is the best solution because Teradici understands VFX challenges and is committed to solving them.* ”

Graham Jack  
Chief Technology Officer, DNEG



NEW Quadro Virtual Workstation - expands virtualization to Quadro RTX 6000 and 8000

- Provision, in minutes, multiple high-end Quadro Virtual Workstations or any combination of virtual workstations and dedicated render GPUs
- Flexible configuration maximizes ROI
- Extend power of RTX platform to designers, on any device, anywhere

# ACCELERATING CREATIVITY

## Most Powerful Rendering Platform



**Media & Entertainment**  
Photorealistic Rendering & Design



**Manufacturing**  
Product Design



**Architecture**  
Design and Rendering

# RTX SERVER - RENDERING

## Accelerated GPU Rendering in the Data Center



Courtesy of Image Engine. © NETFLIX

NETFLIX Lost In Space scene: renders in a fraction of the time using RTX Server

- 7x faster for a single frame
- 27x faster for the entire shot

	CPU Node (Dual Skylake)	RTX Server (4 x RTX 8000)	Improvement
Render time (1 frame)	40 min	6 min	7x
Total render time (120 frames)	80 hours	3 hours	27x
# of nodes	27	1	27x
Power (kW)	14.3	1.9	8x
Acquisition cost	\$203k	\$28k	7x
Cost of power (5 yrs)	\$74k	\$10k	7x
Total cost	\$276k	\$38k	7x

\*note: RTX Server not used in actual Lost In Space production

# RTX SERVER ECOSYSTEM SUPPORT

Quadro Virtual Workstations and RTX Server



“The ray-tracing compute capabilities of NVIDIA’s RTX GPUs and RTX Server, now with virtual workstations, are helping artists push the boundaries of content creation,” said Chris Vienneau, senior director of Media & Entertainment Products at Autodesk. “The Arnold GPU beta is now available to all our customers and we are excited to see how our users will take advantage of the unprecedented rendering speeds and amazing efficiency thanks to the powerful RT Cores, Tensor Cores and CUDA cores.”



“NVIDIA RTX Server delivers a powerful virtual workstation experience for designers and content creators. With Quadro vDWS, artists can easily tackle complex designs and create photorealistic objects, characters and environments at high resolutions,” said David Smith, CEO at Teradici. “In collaboration with NVIDIA for this launch, we are pleased to announce that we have enhanced our PCoIP protocol to support Quadro vDWS GPU acceleration, so Teradici Cloud Access Software customers now have another efficient and powerful option to run their design applications and workflows virtually.”



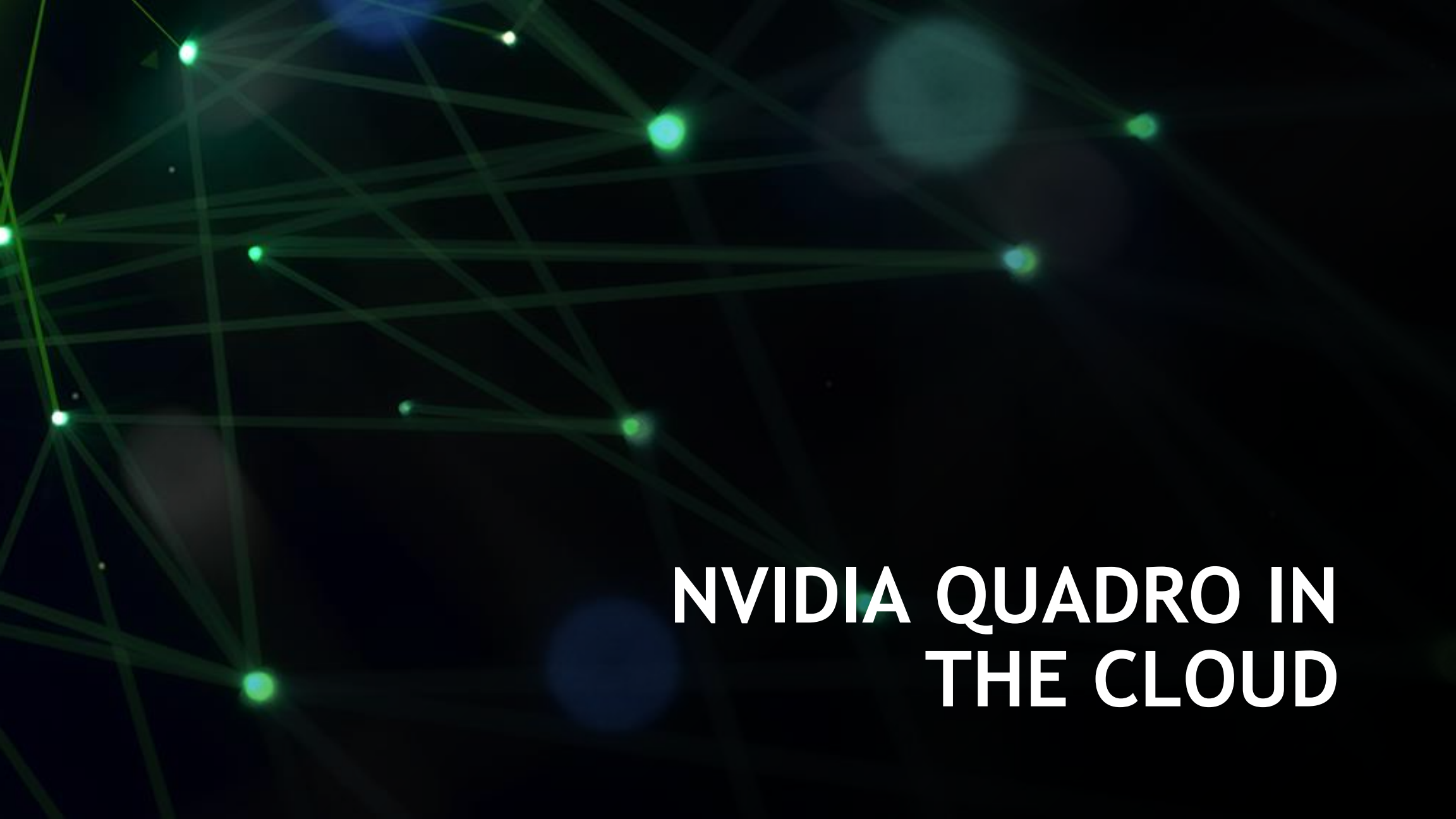
“The Quadro RTX Server with virtual workstation access is a new standard for on-demand rendering in the data center,” said Teri Bruns, vice president of Global Partner Solutions at VMware. “Combined with VMware vSphere and Horizon, multiple users are able to access a single GPU through virtual workstations, dramatically increasing the density of the data center. End-users can also easily provision render nodes and workstations based on their specific needs.”



# GeForce NOW CLOUD SERVICE RUNS ON GRID

Play your favorite PC games on nearly any device anywhere you go like LAYERUNKNOWN'S BATTLEGROUNDS, Fortnite, and more from Steam, Uplay and other popular digital stores. Games load faster and are always up-to-date with the latest patches.





**NVIDIA QUADRO IN  
THE CLOUD**



# PROVEN QUADRO EXPERIENCE, ANYWHERE

Accelerating Design and Engineering Applications



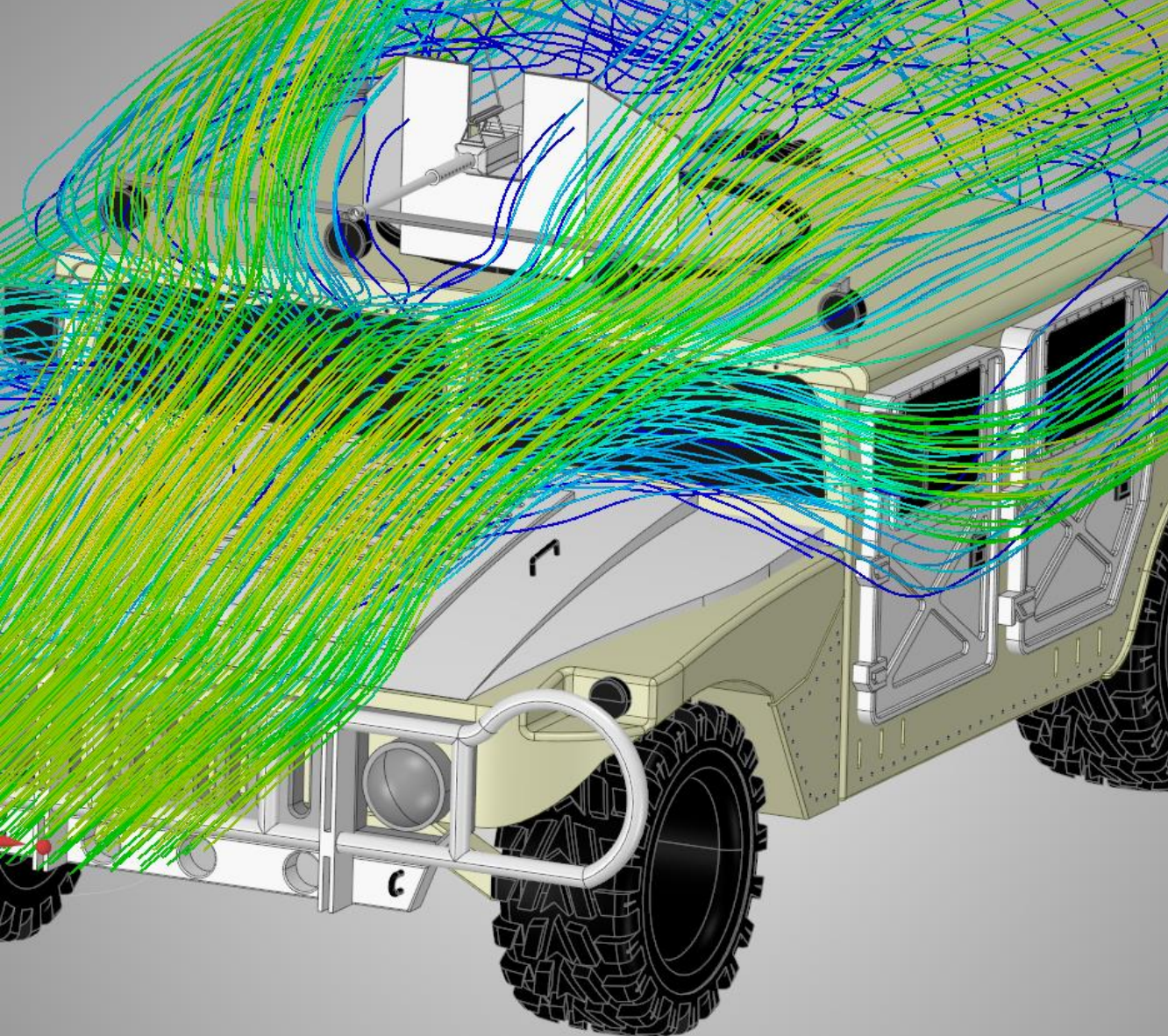
**Quadro in Physical Workstations**  
Quadro in traditional desktop and mobile workstations



**Quadro in the Data Center**  
Quadro workspaces virtualized from the data center with Quadro vDWS



**Quadro in the Cloud**  
Quadro delivered from the cloud with Quadro Virtual Workstation (Quadro vWS)



# A BREAKTHROUGH IN REAL-TIME SIMULATION EXPERIENCE

“With Quadro vWS from the Azure marketplace, design engineers can quickly and easily interact with simulations in real time and iterate design alternatives remotely, on any device, resulting in significant cost and time reductions in the development phase.”

Justin Hendrickson, director of product management at ANSYS



# NEVER MISS A MOMENT OF EXCITEMENT

“When spikes in production demand occur, particularly around major broadcast events like the Olympics or the World Cup, time and budget to set up new temporary editors are a big problem. With Quadro Virtual Workstation on NVIDIA T4 GPUs in the GCP marketplace, I have access to the same Quadro experience on-demand and from anywhere. I can use critical applications like Adobe Premiere Pro, apply GPU-accelerated effects, reposition, scale and rotate clips with a native, workstation-like experience.”

Alvaro Calandra, Consultant and Adobe Certified Master Instructor, ElCanal.com



# CLOUD ECOSYSTEM



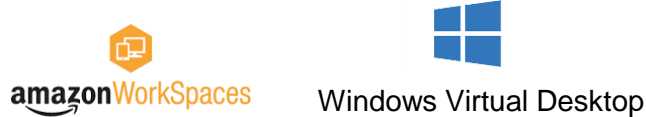
## THIN CLIENTS



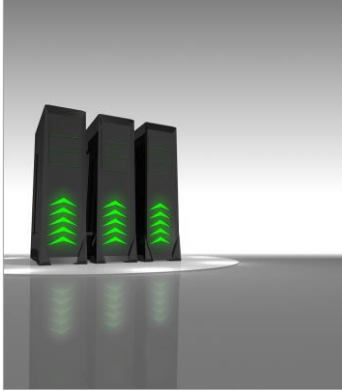
## SOFT CLIENTS



## DaaS



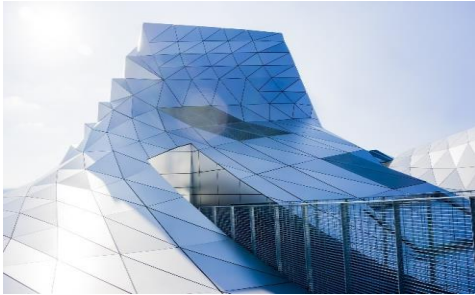
## DaaS MANAGEMENT SERVICES



## INFRASTRUCTURE PROVIDERS



# GPU-ACCELERATED CLOUD COMPUTING IS TRANSFORMING INDUSTRIES



## Architecture

Collaborate in real-time on designs, with the flexibility to adjust consumption based on cyclical project life cycles.



## Manufacturing

Leverage cloud-based workstations running CAD/CAE apps, with enhanced security of IP, and provision the right level of resources for each user.



## Media and Entertainment

Major and independent studios can be more flexible and agile, and easily scale up and down for productions by managing on-demand resources.



## Oil and Gas

Geologists, geophysicists, and engineers can leverage applications running complex 3D data visualizations from the cloud, on any device.

# QUADRO VIRTUAL WORKSTATION


Cloud Adoption News at GTC 2019



Google Cloud Platform



- 1<sup>st</sup> Virtual GPU in the Cloud for improved efficiency
  - Alibaba's VGN5i KVM-based virtual GPU computing instance
- Marketplace Adoption
  - Alibaba
  - Azure
  - More to come....
- T4 Adoption for RTX from the cloud
  - GCP
  - AWS
  - Alibaba



**How to launch an NVIDIA Quadro  
Virtual Workstation instance  
from the Microsoft Azure marketplace**



**GPU VIRTUALIZATION  
AT GTC!**

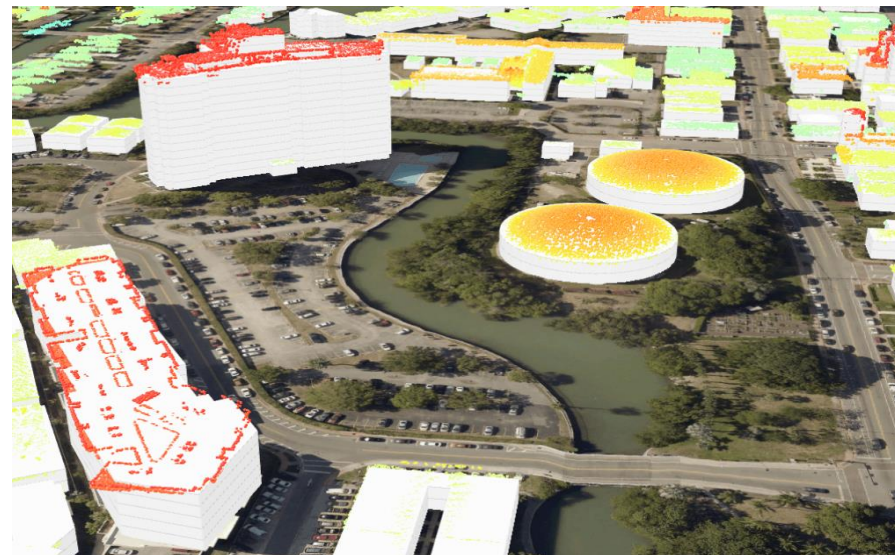


# NVIDIA Virtualization Demos

## Accelerated GPU Rendering in the Data Center



RTX Server with Quadro Virtual Data Center Workstation



Quadro Virtual Data Center Workstation on T4 for AI Enhanced Workloads



# PARTNER DEMOS



Google Cloud Platform



**Hewlett Packard**  
Enterprise

**teradici**<sup>®</sup>



 **NetApp**

 **Microsoft**  
**Azure**

# GPU VIRTUALIZATION TRACK

Hilton Hotel, Almaden 1 Room

Tuesday March 19  
Technology Innovation

10 am S9882-Supercharging Graphics & Rendering with NVIDIA Quadro Virtual Workstations from CSP Marketplaces

11 am S9815-Maximizing Utilization of NVIDIA Virtual GPUs in VMware vSphere for End-to-End Machine Learning

1 pm S9883-Powering Intelligent Video Analytics with NVIDIA Virtual GPU

2 pm S9670-Virtual Desktops by Day, Computational Workloads by Night: An Example Infrastructure

3 pm S9888-Virtual GPU Powers AI and Deep Learning in Universities

4 pm S9884-User Experience is Key to VDI Success, Color Accuracy is Key to User Experience

Wednesday, March 20  
vGPU Customers

9 am S9454-High-Performance Compute & Visualization Platform for Oil & Gas

10 am S9219-Designing & Implementing a VDI Project Powered with GPU Hardware

11 am S9162-Improving Healthcare with Horizon & NVIDIA GPU

1 pm S9741-Network Accelerated GPU Workloads: How 5G and Edge Networks Boost XR

2 pm S9889-From Passthrough to vGPU: PSA Group's Walk through Next-Gen VDI

3 pm S9870-Expert Panel Discussion: See How NVIDIA Quadro Virtual Workstations are Transforming Industries

4 pm S9814-How GPU-Accelerated Virtual Workstations Enable Mobility & Collaboration for Autodesk Applications

Thursday, March 21  
vGPU Partners

9 am S9886-Deliver Extreme Graphics While Achieving Great TCO with HPE SimpliVity HCI & NVIDIA GPUs

10 am S9881-Using Industry Standard Benchmark Tools to Size Graphics Accelerated Applications

11 am S9231-Leveraging NVIDIA, Citrix and IGEL to Support Unified Communications in VDI



# GPU VIRTUALIZATION TRACK

## CUSTOMERS



**CANNONDESIGN**

## INNOVATION




- What's New with NVIDIA vGPU?
- Video Analytics - Deepstream
- Quadro Virtual Workstation in the Cloud
- User Experience is the Key to VDI Success
- Mixed Workloads with vGPU Technology
- Virtual Labs for Education





## PARTNERS



# CISCO VDI SOLUTION BUNDLES

Base Experience	Enhanced Experience (Rack)	
<p>UCS C240 M5 SKU: LW87648192M</p>	<p>UCS C240 M5 SKU: AB903763620P</p>	<p>UCS C240 M5</p>
<p> GRID vPC licenses (64 users) 2 x M10</p>	<p> GRID vPC licenses (64 users) 4 x T4</p>	<p> GRID vPC licenses (96 users) 6 x T4<sup>1</sup></p>

Enhanced Experience (Blade)	
<p>UCS B200 M5 SKU: XE90022273VT</p>	<p>8 x UCS B200 M5, 1 Chassis</p>
<p> GRID vPC licenses (32 users) 2 x Tesla P6</p>	<p> GRID vPC licenses (256 users) 16 x Tesla P6</p>

1. Cisco C240 M5 bundle with 6 x NVIDIA T4 GPUs with GRID licenses for 96 users coming soon.

# DELL VDI COMPLETE ENHANCED BUNDLE TEMPLATES

## Graphics Enhanced

Powered by vSAN Ready Node

### PowerEdge R740XD

Hybrid Disk Storage

2 x Intel Xeon Gold 5120 (14C)

384 GB Memory

2U Server Platform x/2000W PSU



GRID vPC licenses (64 users)

2 x M10

VMware Horizon 7 Advanced

Preferred Endpoints

Wyse 3040 Thin Client, Wyse 5070 Thin Client,  
OptiPlex 3060

## Graphics Enhanced

Powered by vSAN Ready Node

### PowerEdge R740XD

Hybrid Disk Storage

2 x Intel Xeon Gold 5120 (14C)

384 GB Memory

2U Server Platform x/2000W PSU



GRID vPC licenses (64 users)




4 x T4

VMware Horizon 7 Advanced

Preferred Endpoints

Wyse 3040 Thin Client, Wyse 5070 Thin Client,  
OptiPlex 3060

# HPE VDI SOLUTION BUNDLES

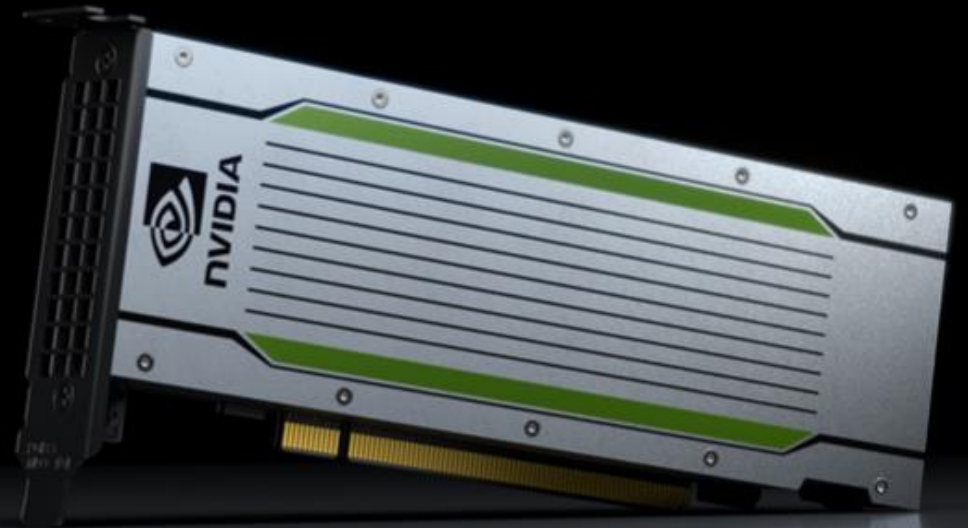
64 USER M10	96 USER M10	64 USER T4
 DL380 Gen10	DL380 Gen10	DL380 Gen10
GRID vPC licenses (64 users) 2 x M10	 GRID vPC licenses (96 users) 3 x M10	 GRID vPC licenses (64 users) 4 x T4



# NVIDIA T4 FOR VIRTUAL WORKSTATIONS

Universal GPU for Everyone

- **Quadro Workstation from the Cloud**
  - Alibaba
  - AWS
  - Google
  - Azure
- **Professional Workstation Performance on T4**
  - Up to 2X graphics performance versus M60
  - 5 Giga Rays per second for real-time, interactive rendering
- **Virtual PCs for the Knowledge Worker**
  - Up to 33% improved performance compared to CPU-only VMs
  - NEW Windows 10 Migration Acceleration Program



# MIXED REALITY SOLUTIONS FOR RETAIL OPTIMIZATION AND SHOPPER ENGAGEMENT

Surveys to customers showing realistic virtual simulations powered by Frame and Microsoft Azure enable companies a risk-free and cost effective way on a pay-by-the-minute basis to get feedback and iterate on new concepts for their shop floor.





**nVIDIA**®