TeamRGE

Remoting Graphics Experts

Hard Facts - Benchmarking GRID-Accelerated Remote Desktop User Experience

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VDI Design
Benchmarking
Workspace Analytics

Communities

Microsoft MVP Most Valuable Professional

Microsoft Regional Director

vmware vEXPERT

vmware EUC CHAMPION 2016

Citrix Technology Professional

NVIDIA GRID Community Advisor

fslogix

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Citrix ctp Technology Professional

2008-2017

NVIDIA GRID Community Advisor

FRAME

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AppVirtGuru

What Matrix

Executive
Field CTO
Workspace
Public Cloud Computing

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CONSULTANT - PRE-SALES & ARCHITECTURE

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CTO

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END USER COMPUTING CONSULTANT

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PERFORMANCE ENGINEERING LEAD ARCHITECT AT NVIDIA

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END USER COMPUTING AND REMOTE GRAPHICS SPECIALIST AND OWNER AT FIRSTPOINT BERGEN AS

RASMUS RAUN NIELSEN

SENIOR SYSTEMS CONSULTANT, CONECTO

RUBEN SPRUIJT

CTO

SHAWN BASS

CTO - END-USER COMPUTING AT VMWARE

THOMAS POPPELGAARD

INDEPENDENT CONSULTANT / TECHNOLOGY EVANGELIST

TeamRGE
Remoting Graphics Experts

www.teamRGE.com

“Sharing your knowledge doesn't put your job at risk.
It empowers you to perform at a higher level, Iron sharpens iron.”
#CommunityPower

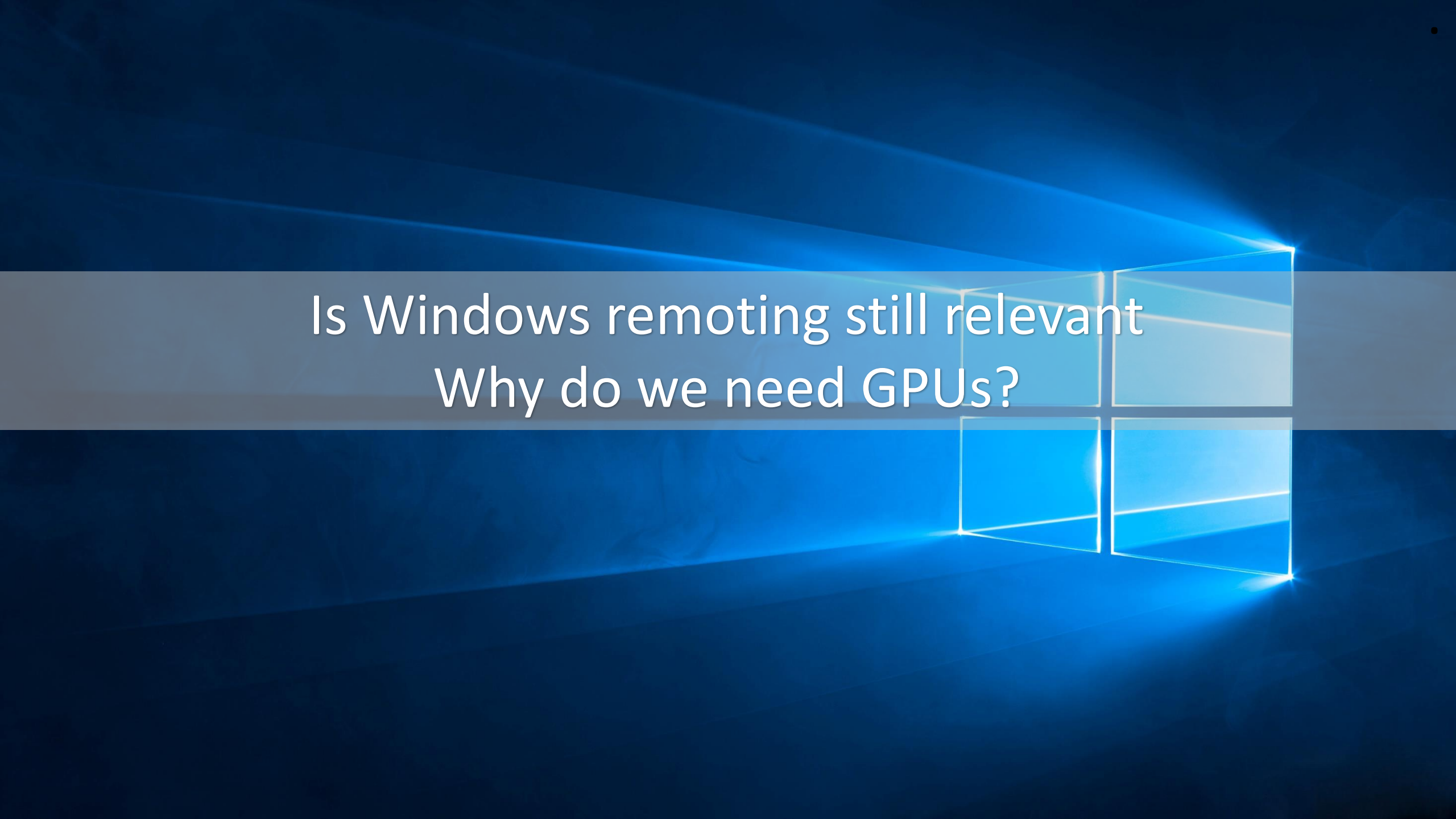
SESSION TOPICS

Session topics

1. Windows, GPUs and GPU options

2. How to benchmark, tooling and lab setup

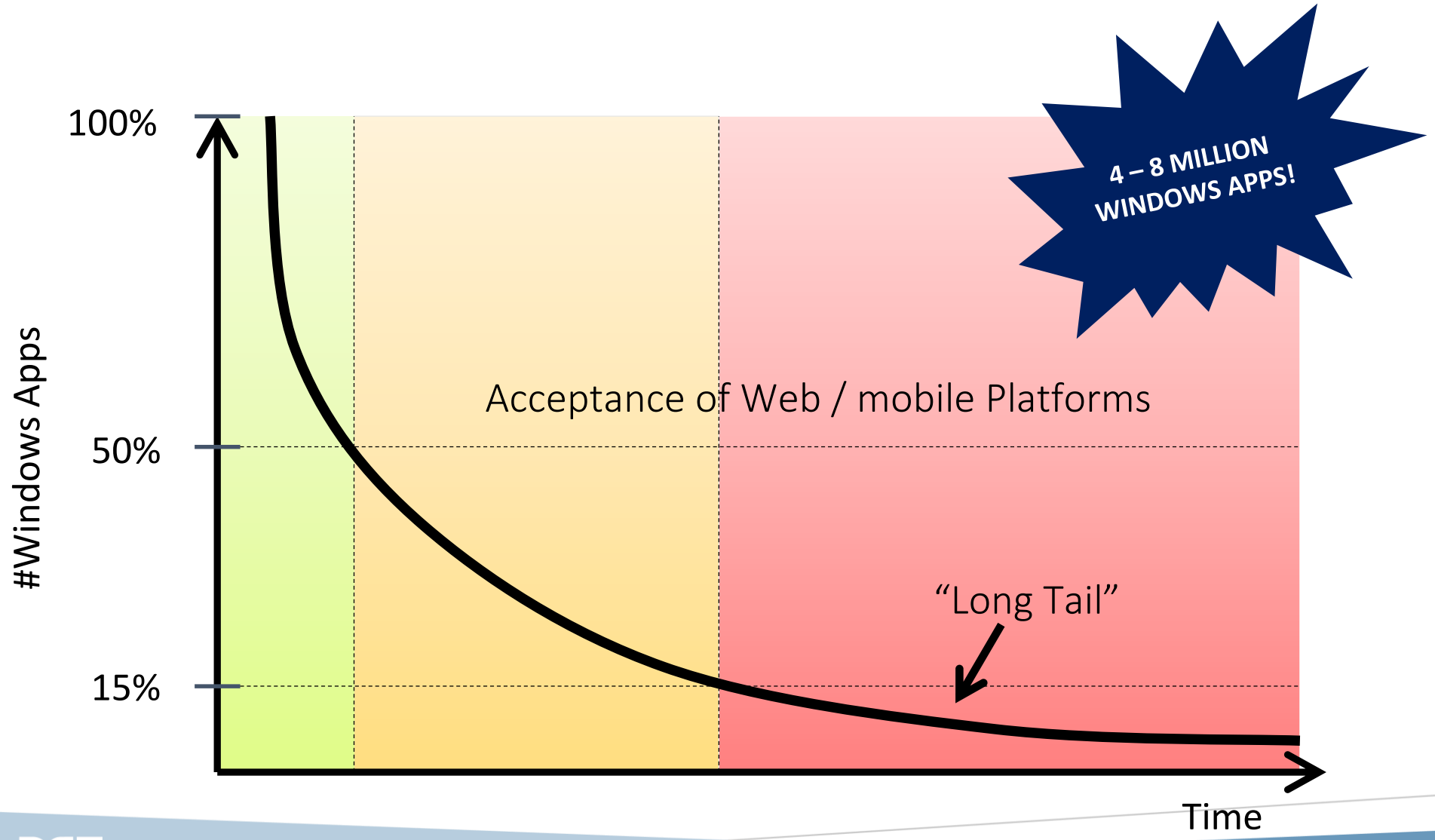
3. Benchmark results


Is Windows remoting still relevant
Why do we need GPUs?

Windows everywhere is dead!?

Windows isn’t dead!

Cloud Adoption Rate and the “Long Tail”



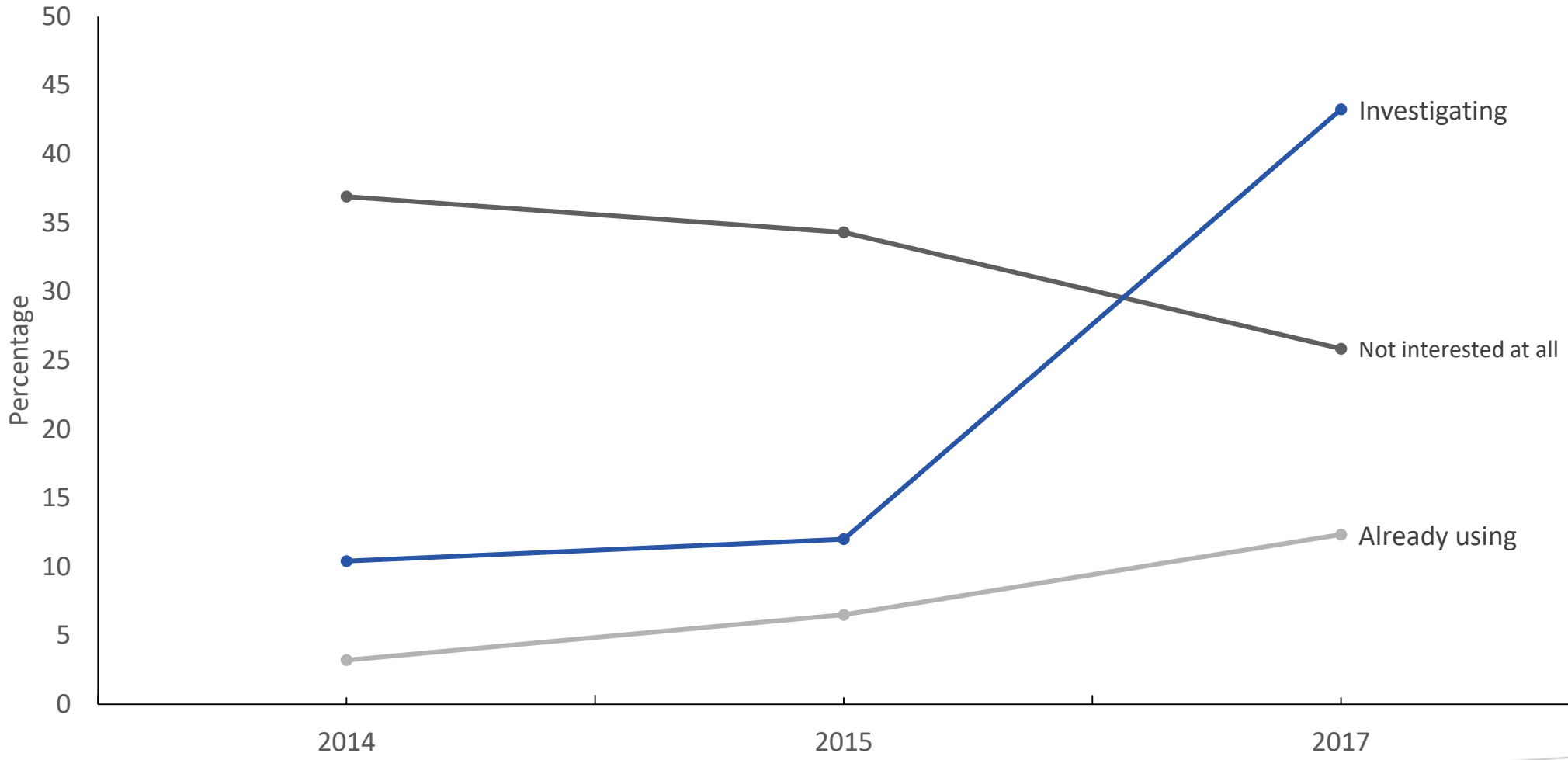
“After a nuclear war, it'll be cockroaches and Windows apps”

Shawn Bass – Team Remote Graphics Experts – TeamRGE.com

WWW.VDILIKEAPRO.COM

Virtual Client Computing upstart in Cloud and Mobile 1st world

How interested are you in DaaS or Remote Application as a Service offerings?



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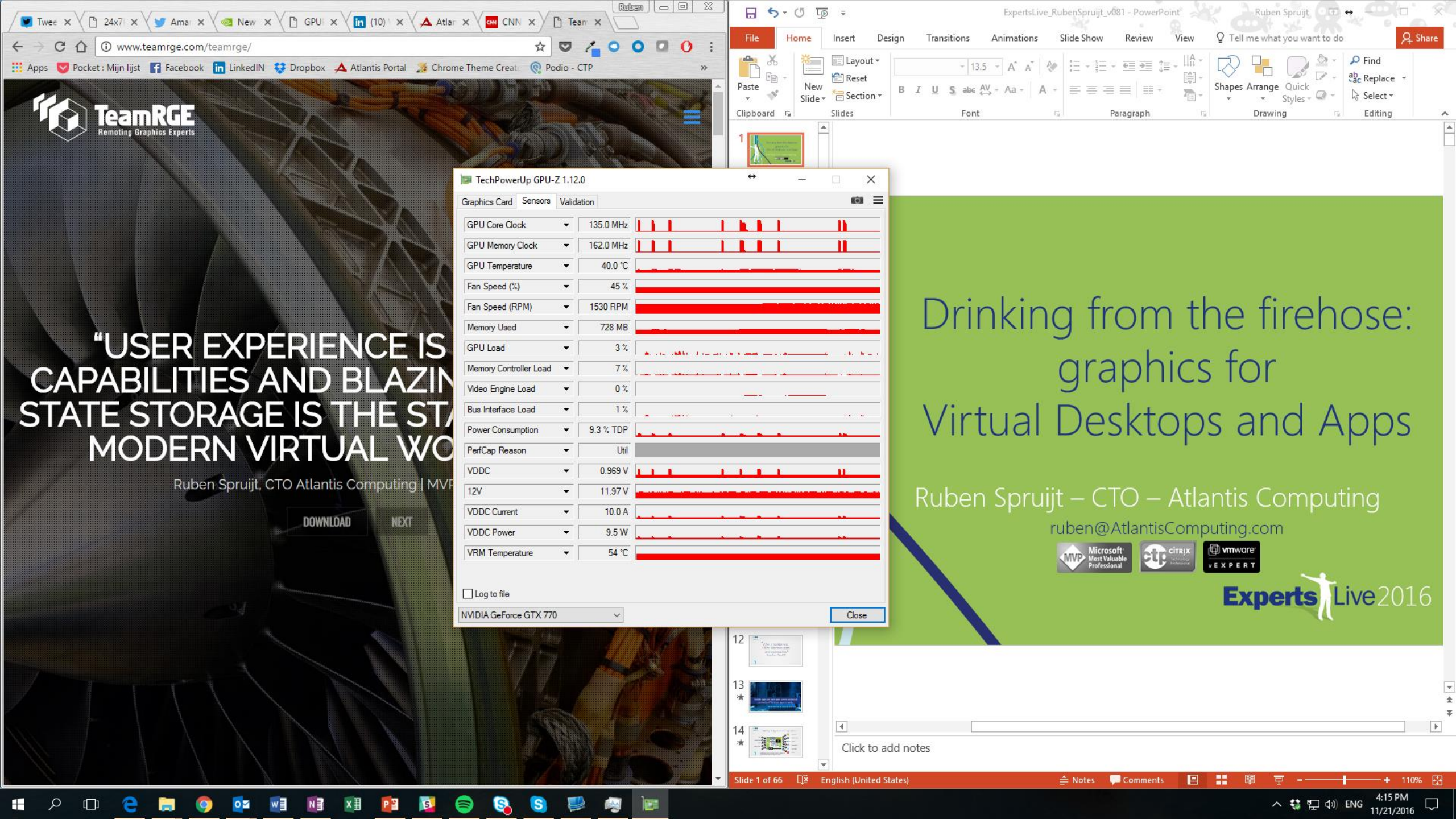
Popular Graphics Applications

How much video framebuffer (memory) do you use for OS and Applications?
Why is this important?!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NEXT
TechPowerUp GPU-Z 1.12.0
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Validation
GPU Core Clock 135.0 MHz
GPU Memory Clock 162.0 MHz
GPU Temperature 40.0 °C
Fan Speed (%) 45 %
Fan Speed (RPM) 1530 RPM
Memory Used 728 MB
GPU Load 3 %
Memory Controller Load 7 %
Video Engine Load 0 %
Bus Interface Load 1 %
Power Consumption 9.3 % TDP
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VDDC Power 9.5 W
VRM Temperature 54 °C
Log to file
NVIDIA GeForce GTX 770
Close
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graphics for
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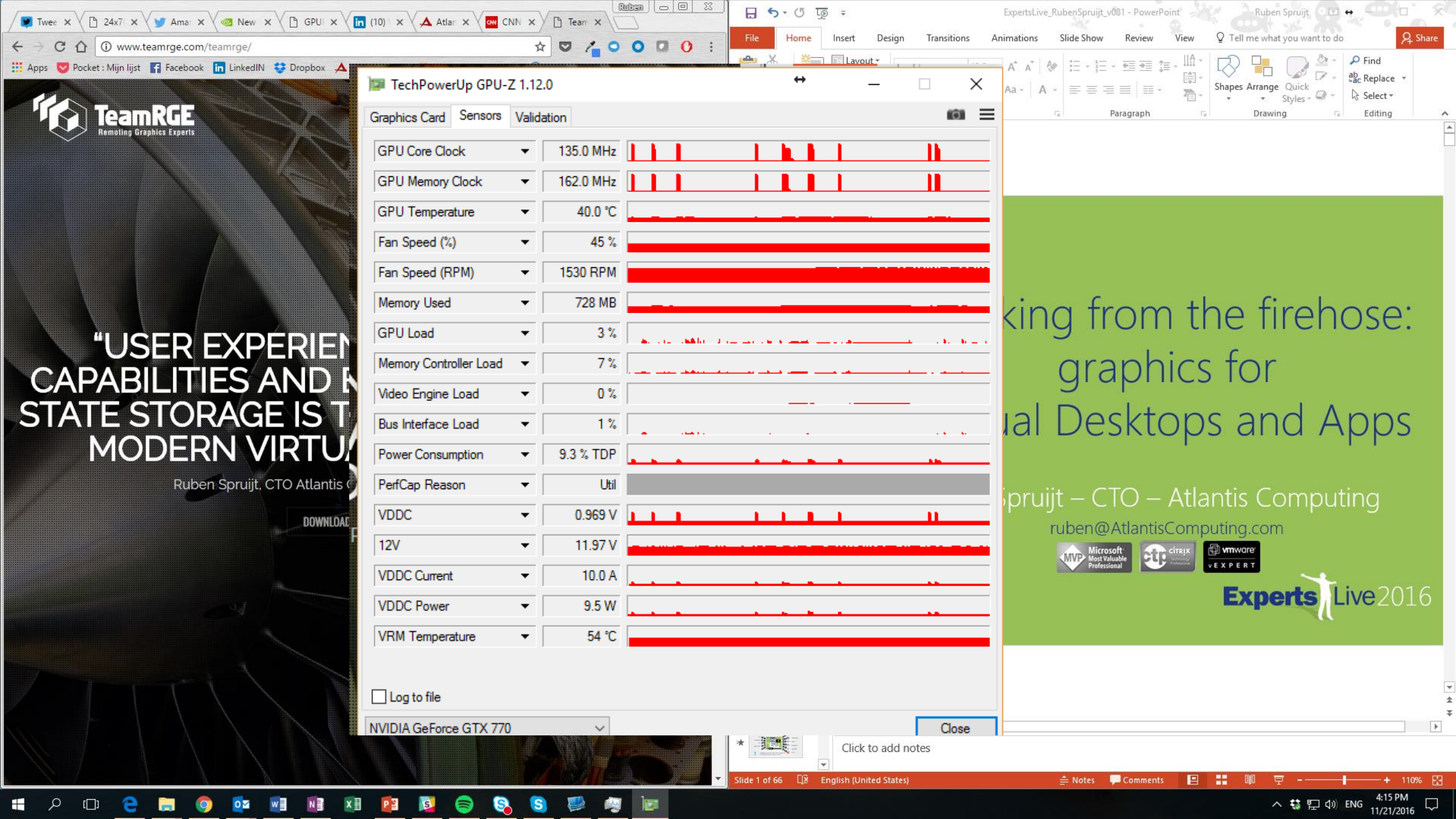
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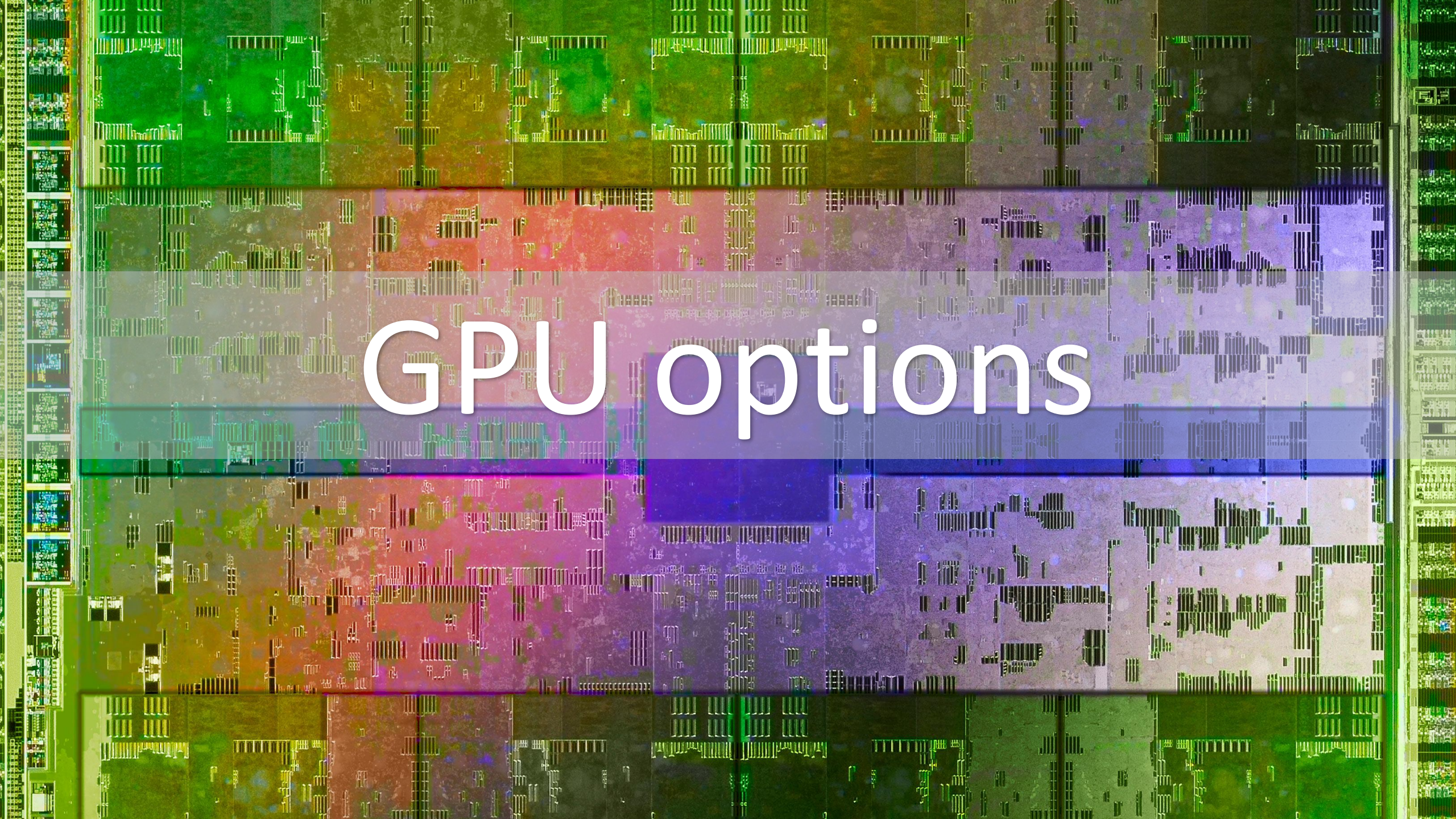
Virtual Desktop

- Task and Knowledge Workers
- Office, CRM, ERP, Unified Comm.
- Basic compute resources
  - 1-4GB RAM | 256GB-512GB SSD
  - Core i5/Core i7
  - Geforce GT(X)– Quadro 420/620/K1200
- 700-1500 Desktop range

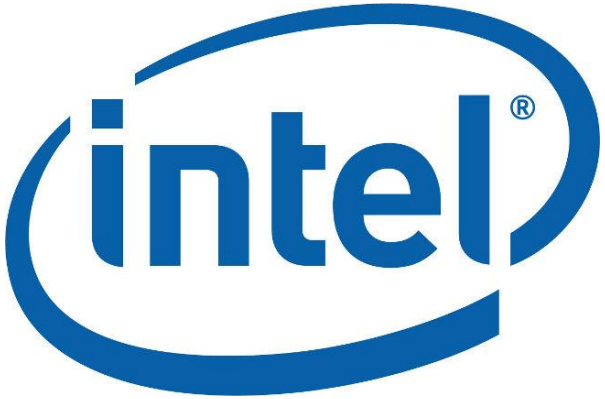
Virtual Workstation

- Power Users and Designers
- 2D/3D graphics, CAD/PLM/BIM
- High-end compute resources
  - 4-64+ GB RAM | Xeon MP
  - Multiple SSD, PCIe Flash 512GB+
  - NVIDIA Quadro K2000-M6000
- 1500-10K$+ Workstation range


GPU options

GPU Manufacturers

Multiuser GPU
SR-IOV + Pass-Thru GPU
“Pure Hardware”
Dedicated vRAM + GPU



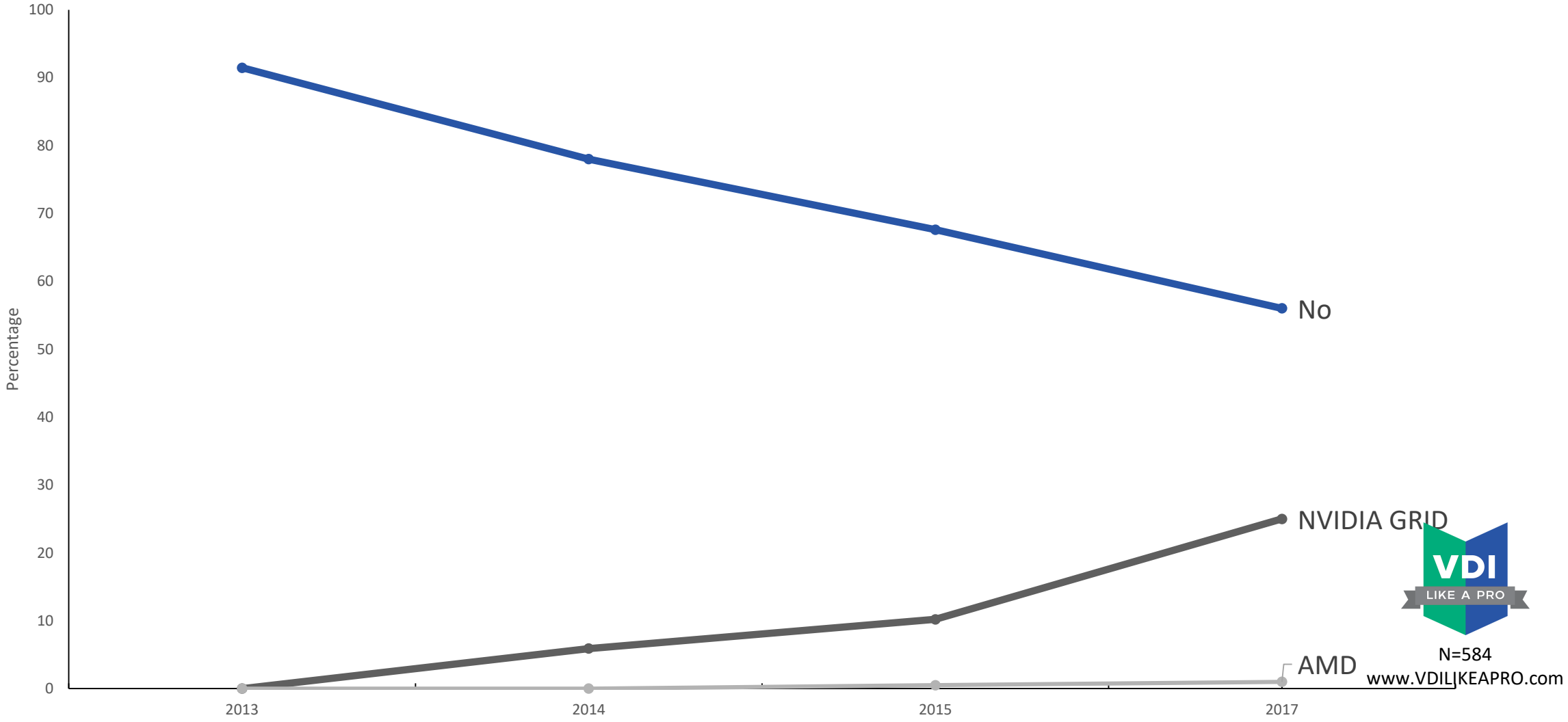
Iris Pro Graphics + GVT
Xeon E3-1200 v4 CPU + Iris Pro
“Broadwell” CPU + GPU = APU
“Skylake”

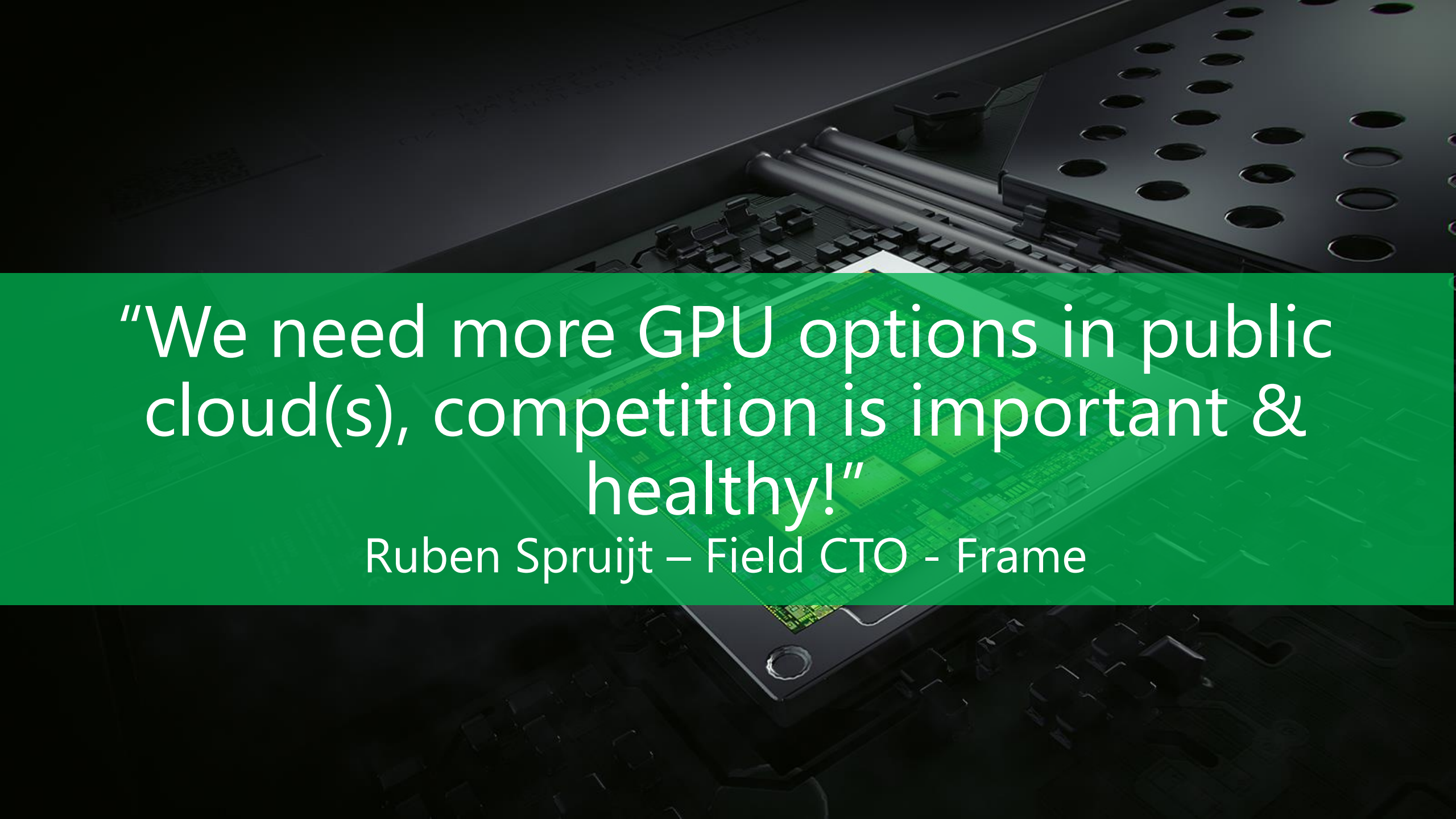
GRID vGPU
TESLA M6 / M60 / M10 (“Maxwell”)
“Software Stack”
Dedicated vRAM, shared GPU

Glossary
GPU = Graphics Processing Unit
GVT = Graphics Virtualization Technology (Intel)
SR-IOV = Single Root I/O Virtualization
APU = Accelerated Processing Unit

Download whitepaper at http://www.teamrge.com

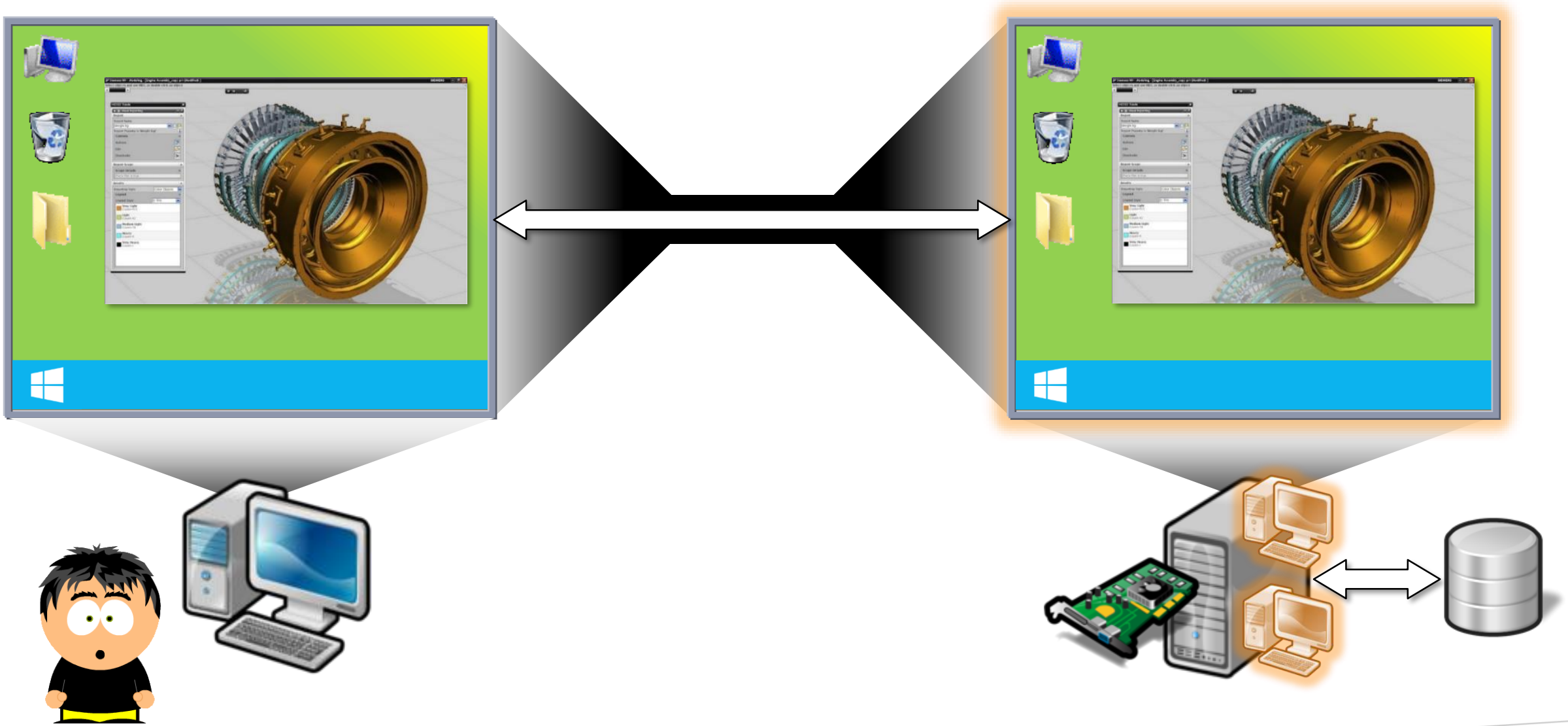
Do you use offloading technology or GPUs in your Virtual Workspace environment?




“We need more GPU options in public cloud(s), competition is important & healthy!”
Ruben Spruijt – Field CTO - Frame

Benchmarking

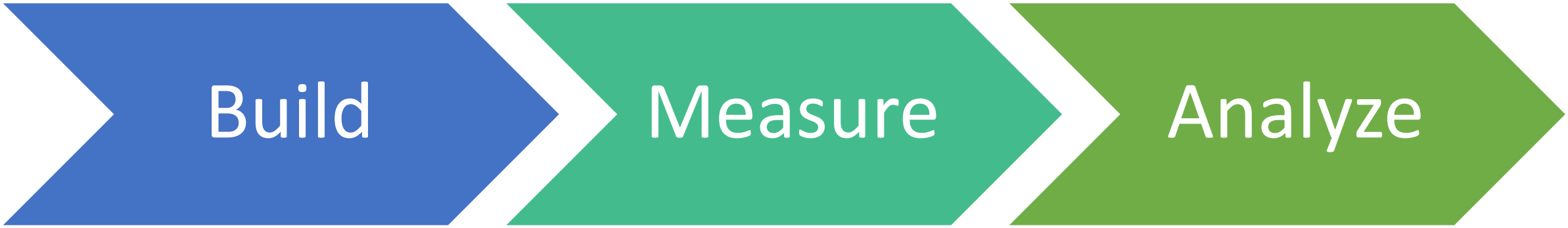
GPU-Accelerated Remoting



Relevant Remote End User Experience Factors

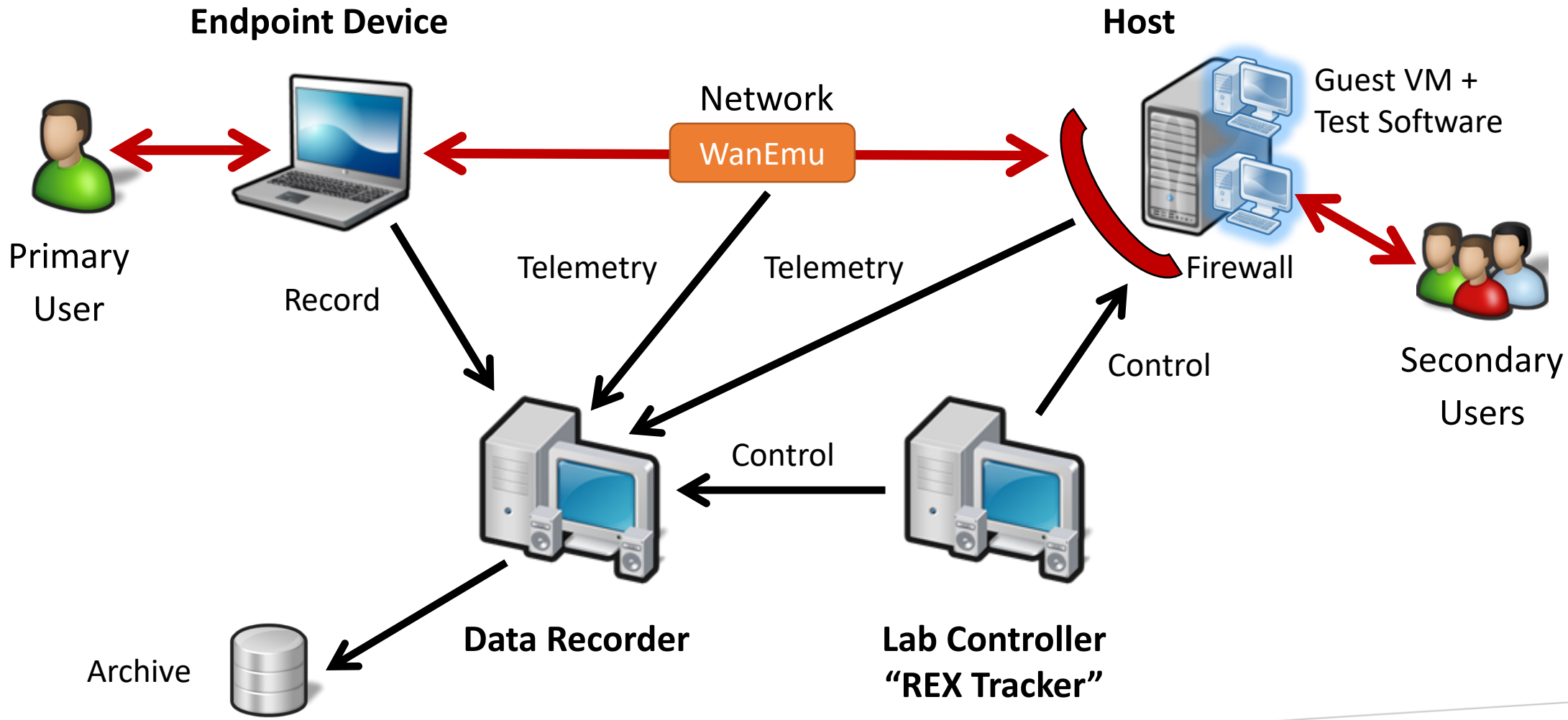
- Remoting protocol (Codec, protocol stack, streaming)
- Application type (GDI, DirectX, OpenGL, video, …)
- Host (server hardware & hypervisor, GPU support)
- Guest VM (Windows version, remoting components)
- Endpoint (client hardware & software, screen resolution)
- Network (TCP/UDP, bandwidth, latency, packet loss, VPN)
- Control plane (connection broker, gateway, …)
- In shared environments: other users (noisy neighbors)

Benchmarking Workflow



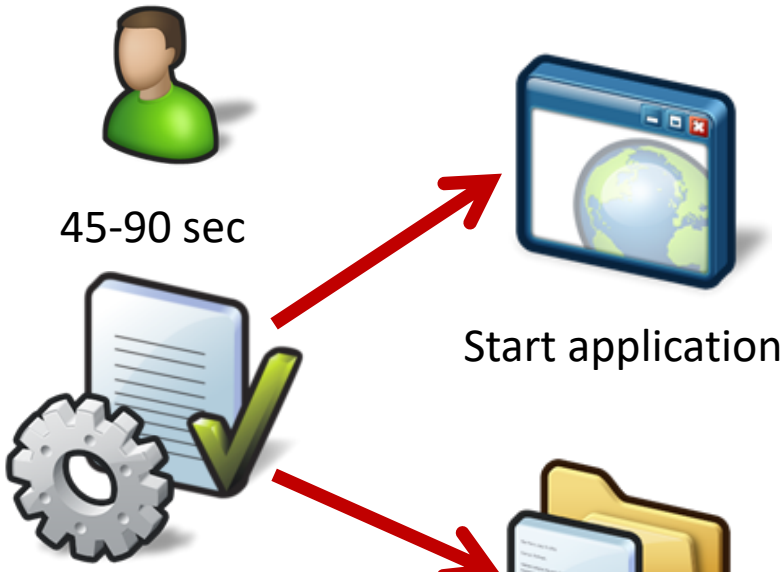
“EUC platform testing is great in on-premises world from a sizing and best-practices perspective but doesn’t add much value in public clouds”

Building a Remote Desktop Benchmarking Lab



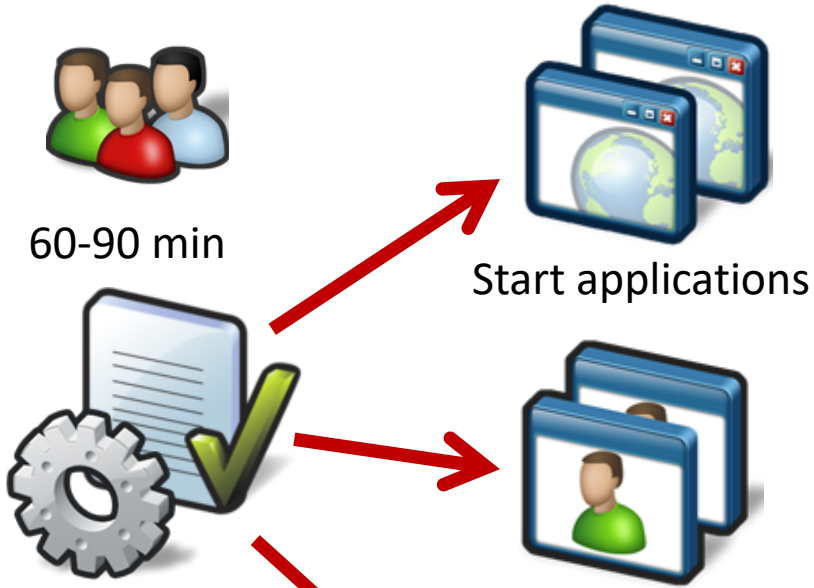
Producing Synthetic User Workloads

Primary Workload Sequences



Media Formats
- GDI
- Video
- Flash
- HTML5
- DirectX
- OpenGL

Secondary Workload Sequences



Personas
- Task Worker
- Info Worker
- Power User
- Office User
- Knowledge Worker
- Media Designer

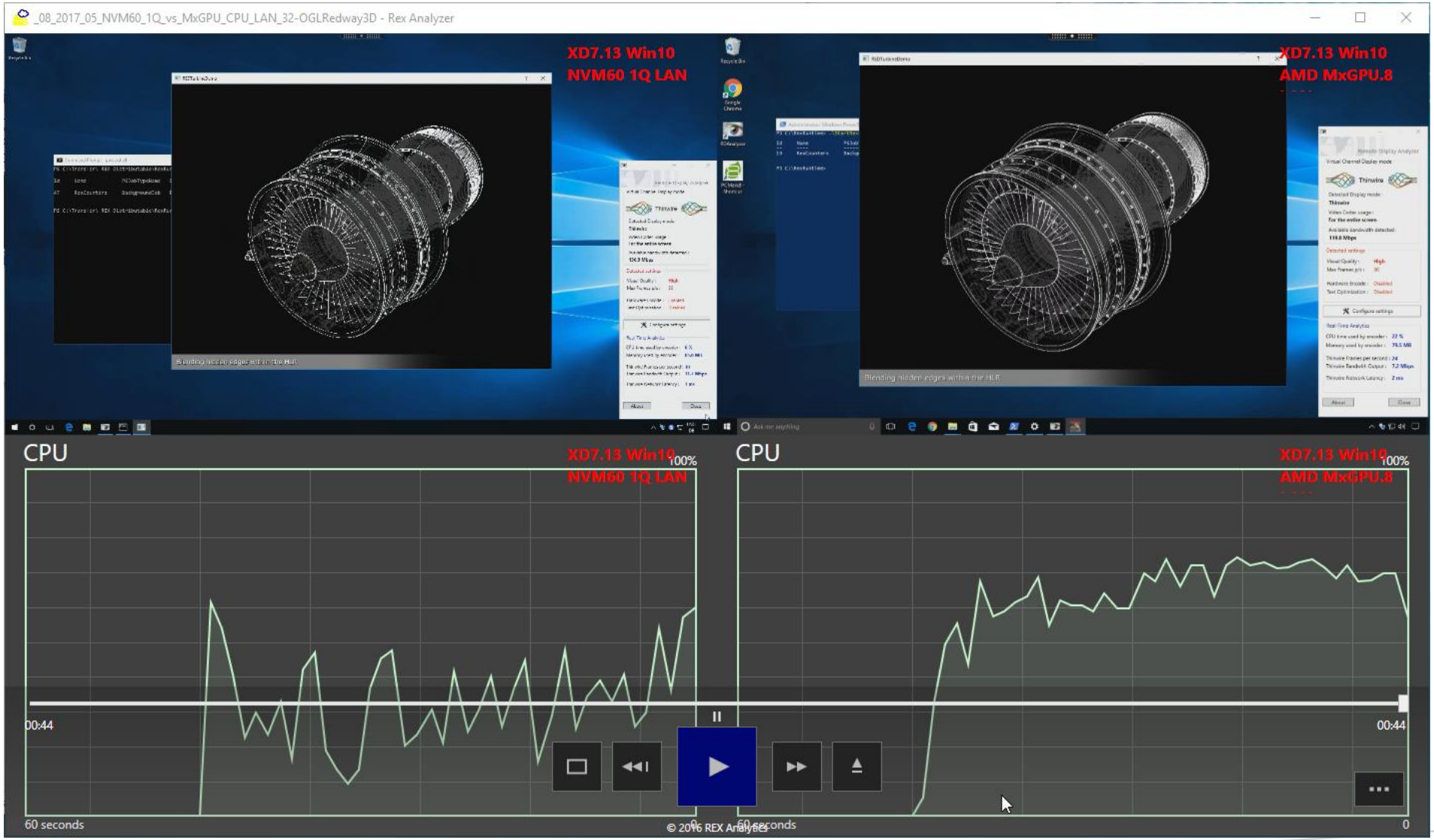
Measuring Remote End User Experience (REX)

- Perceived user experience
- User interface response times - click to noticeable action and application start times
- Graphical output performance
- Screen refresh cycles - frame rates, flicker
- Supported graphics and media formats
- Dropouts, blurriness and artefacts - media quality

Remote end user experience cannot be represented by a single score

Solution: REX Analytics = screen videos + correlated telemetry data

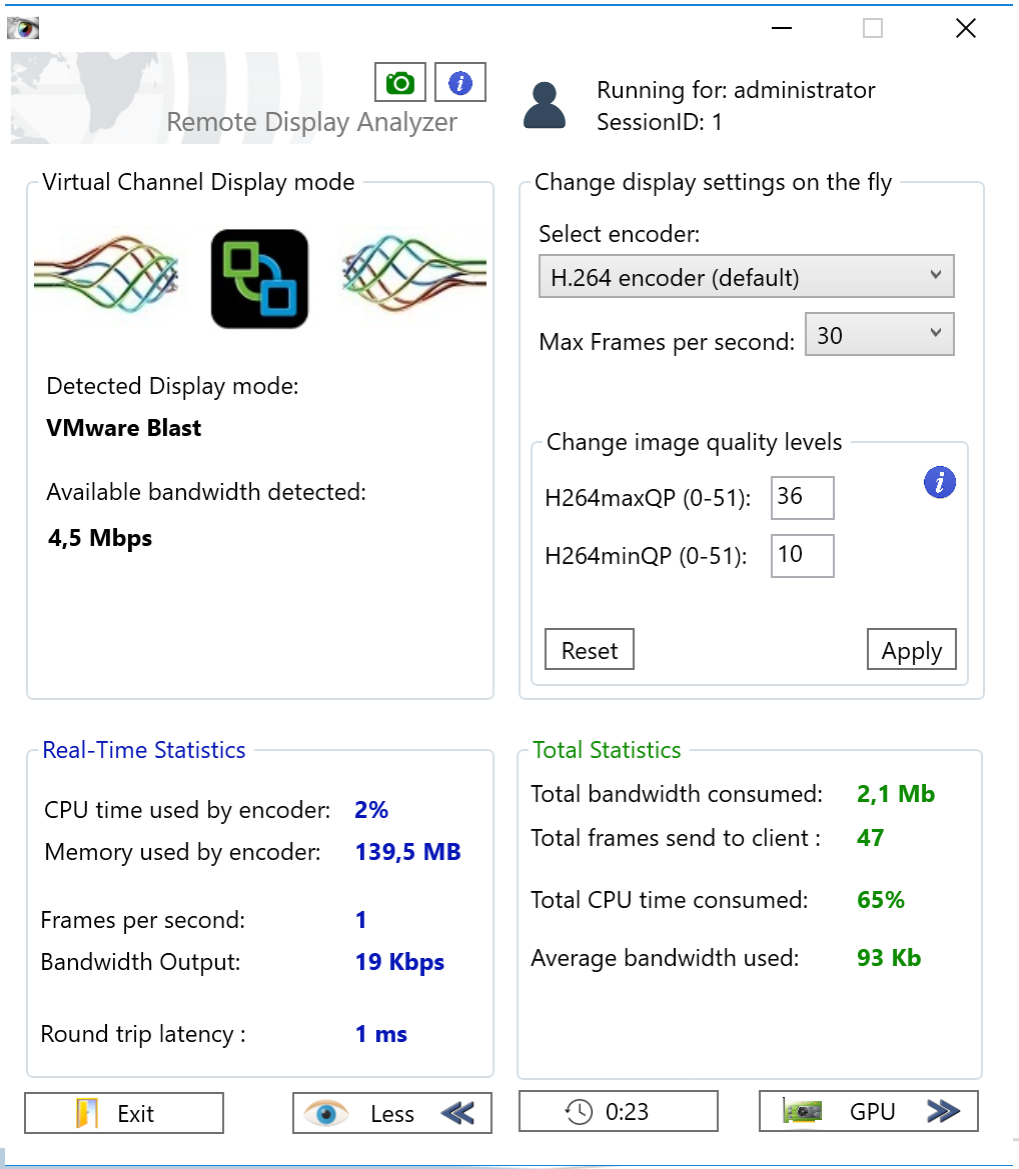
Comparison – REX Analyzer



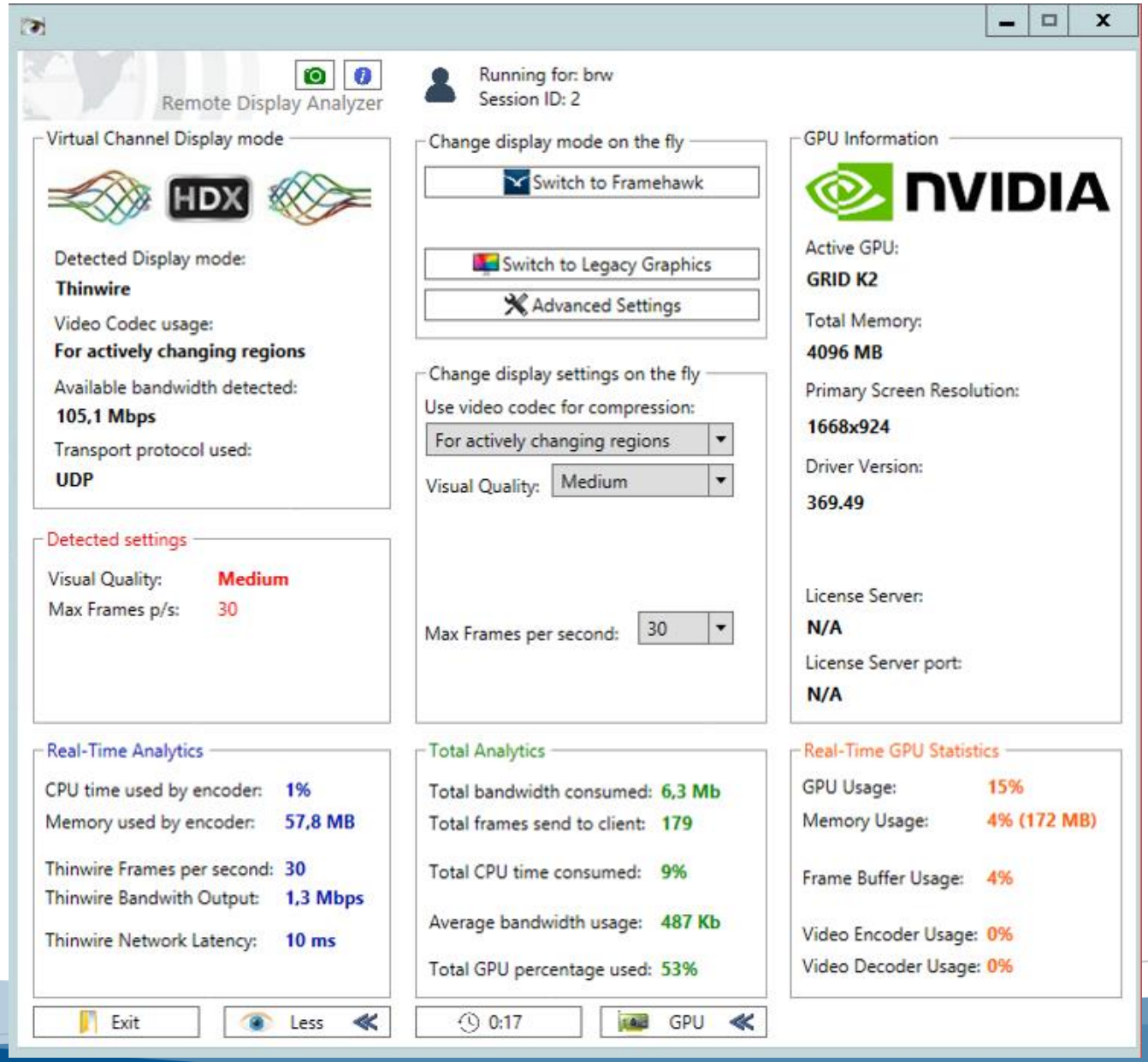
PREVIEW

RDANALYZER v2.0

Remote Display Analyzer 2.0 - preview



Remote Display Analyzer 2.0 - preview



PREVIEW

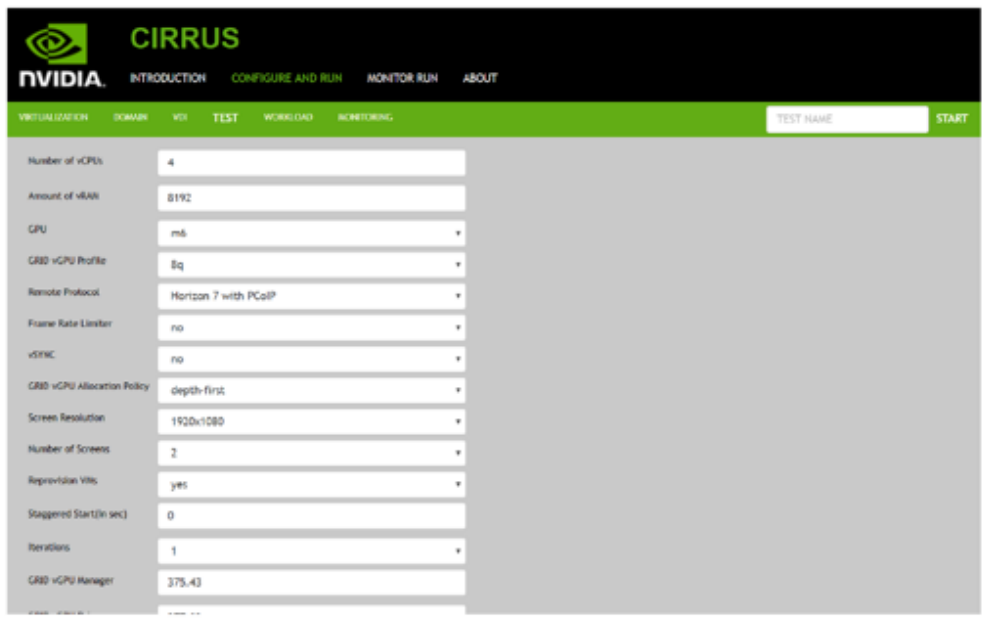
PROJECT CIRRUS

BENCHMARKING WITH CIRRUS

Quantifying User Experience and Scale with NVIDIA Expertise

- Data driven sizing and configuration decisions
- **UNIQUELY** quantifies remoted user experience
  - Measures end user latency
  - Frames remoted to end users
  - Consistency of end user experience
  - Resource consumption
- Outputs realistic sizing recommendations

New



“EUC platform testing and UX benchmarking aren’t the same. Different goal and different end-result”

Latency

Relevant Network Factors

Remoting Protocols (RDP, ICA/HDX, PCoIP, Blast, …)

Bandwidth

Data transfer rate of a network connection

Latency

Delay; amount of time to traverse a system
>300ms half way around globe
>500ms for VSAT satellite links

Packet Loss

Discarding of data packets (in percent)

It’s Einstein’s Fault…

40,000km

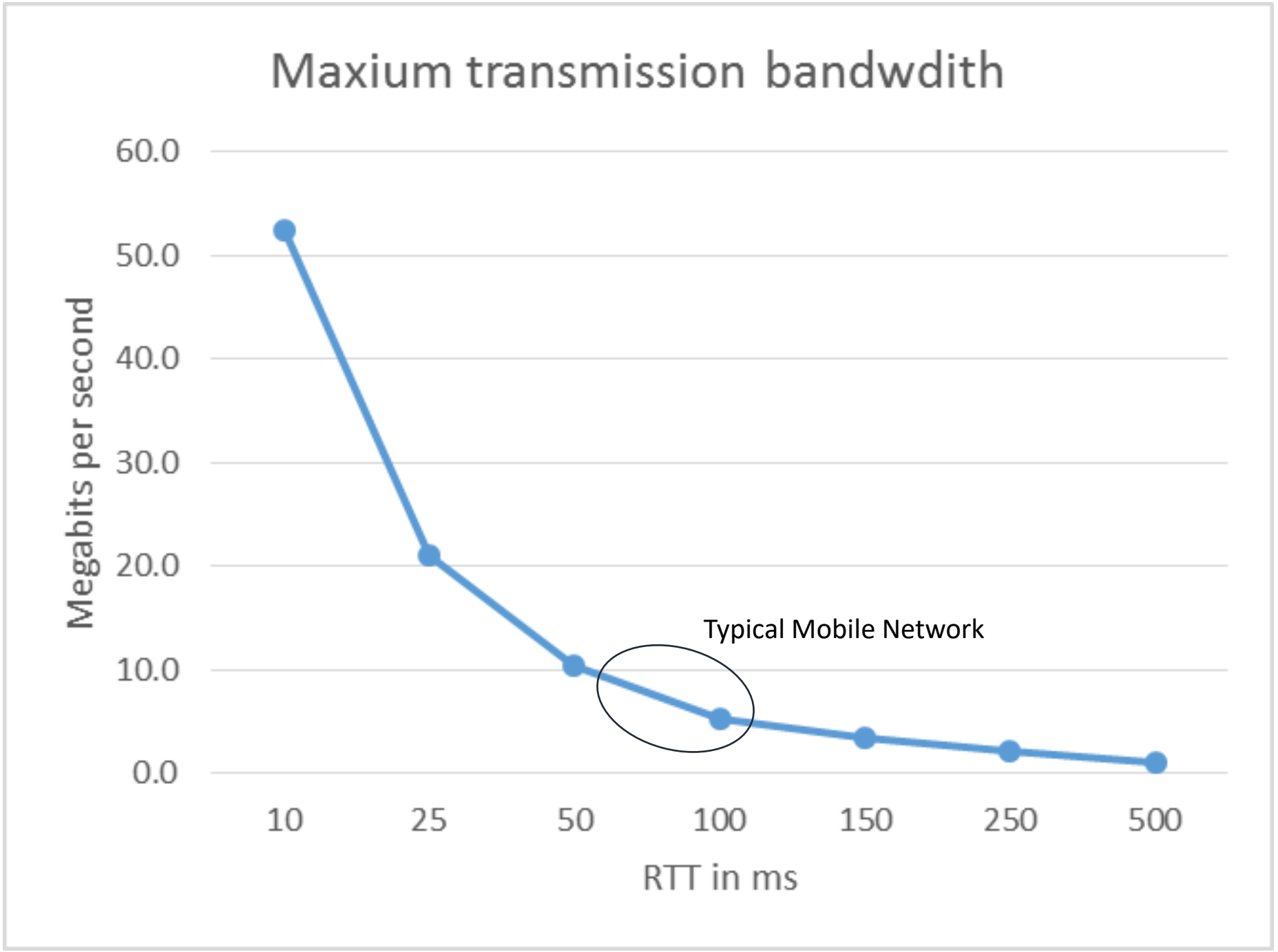
~130ms

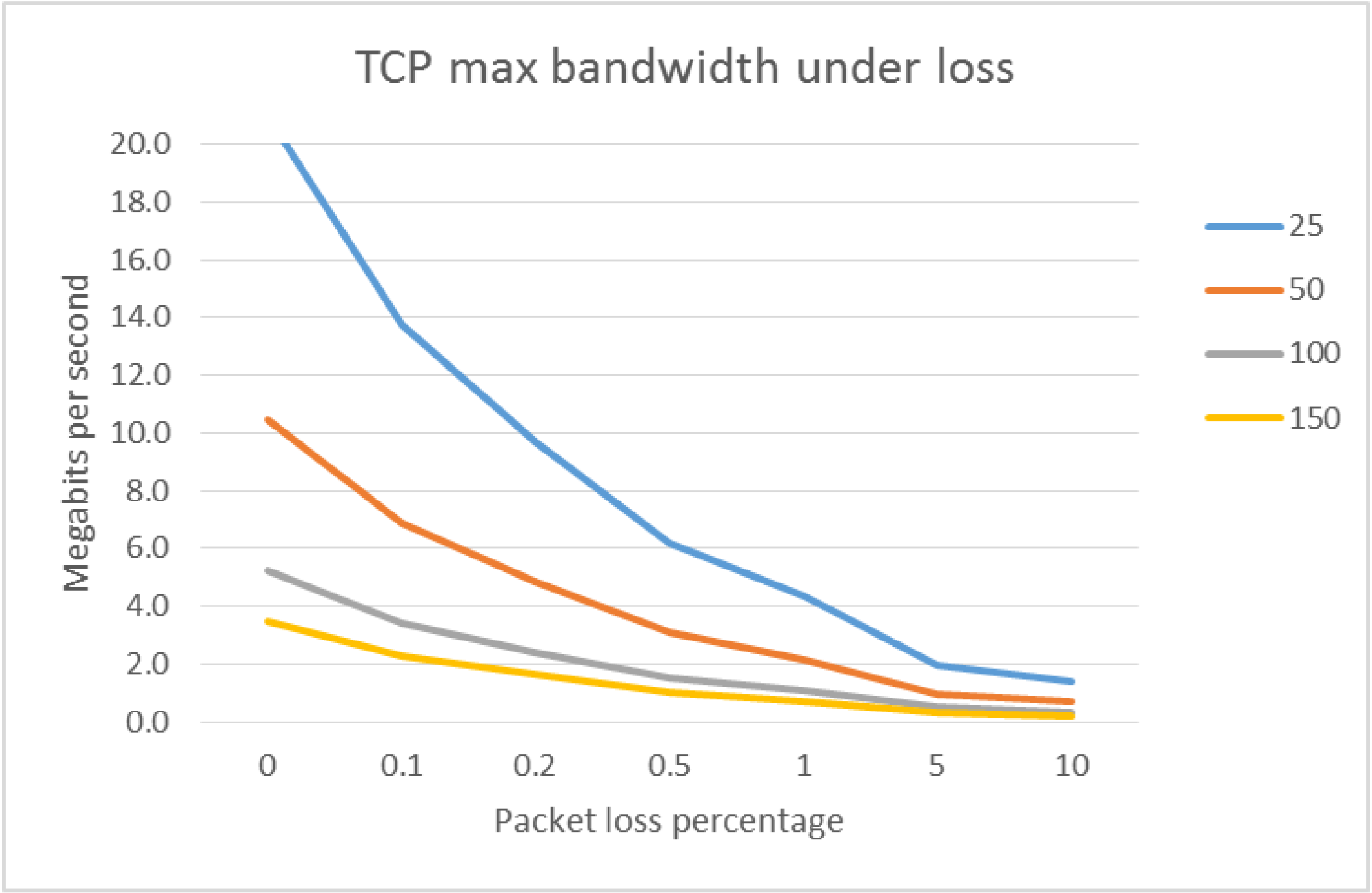
Speed of light

c ≈ 300,000km/sec

VF%	Cable
74–79	Cat-7 twisted pair
77	RG-8/U
67	optical fiber
65	RG-58A/U
65	Cat-6A twisted pair
64	Cat-5e twisted pair
58.5	Cat-3 twisted pair

Minimum velocity factors for network cables


Maxium transmission bandwdith
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Megabits per second
Typical Mobile Network
10
25
50
100
150
250
500
RTT in ms


TCP max bandwidth under loss
Megabits per second
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
0.1
0.2
0.5
1
5
10
Packet loss percentage
25
50
100
150

HDX 3D Pro – Win7 VM and Win7 Client Device Latency (in milliseconds)

NVIDIA Click-to-Photon benchmark

Testing DDA – Azure N-Series VMs

	NV6	NV12	NV24
CPU Cores (E5-2690v3)	6	12	24
RAM (GB)	64	112	224
SSD (GB)*	340	680	1.440
Network	Azure	Azure	Azure
GPU Resources	1 x M60 GPU (1/2 physical card)	2 x M60 GPUs (1 physical card)	4 x M60 GPUs (2 physical cards)
Price (West Europe)	$1.60/hr $1,190.40/mo	$3.19/hr $2,373.36/mo	$6.38/hr $4,746.72/mo

Benchmarking results

What is the most important thing we should benchmark from a UX perspective?!

WE WANT YOUR INPUT!

SUMMARY

Session topics

1. Windows, GPUs and GPU options

2. How to benchmark, tooling and lab setup

3. Benchmark results

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THANKS!

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