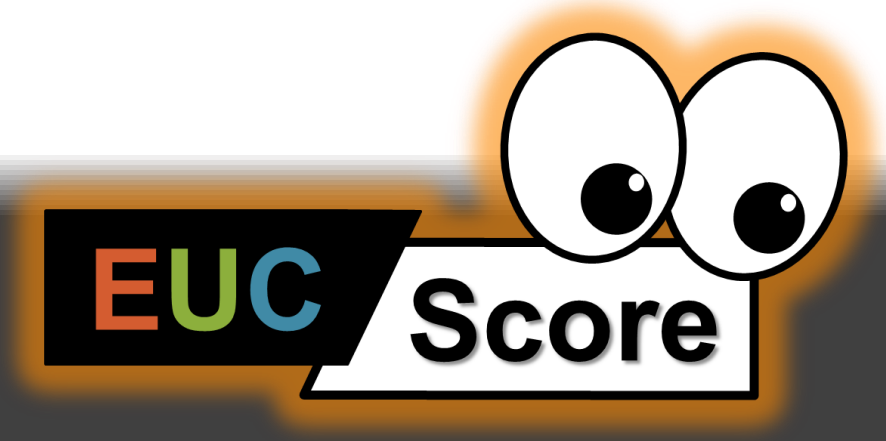

What users really expect from Windows in the cloud - and three ways to (not) deliver it

E2EMVC 2025, Amsterdam

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info@eucscore.com | https://drtritsch.com | linkedin.com/in/drtritsch

Windows is like the shell of a house

- **Foundation**: Concrete slab, footings, foundation walls and basement
- **Framing**: Walls and roof trusses
- **Exterior**: Sheathing, thermal insulation, windows and doors
- **Roof**: Roof decking and underlayment
- **Utilities**: Electrical wiring, plumbing, heating, ventilation, air conditioning and networking infrastructure

But there are a number of things missing to make it habitable…

Builder, Owner & Host

EUC

“Admin Experience”

Hard Metrics

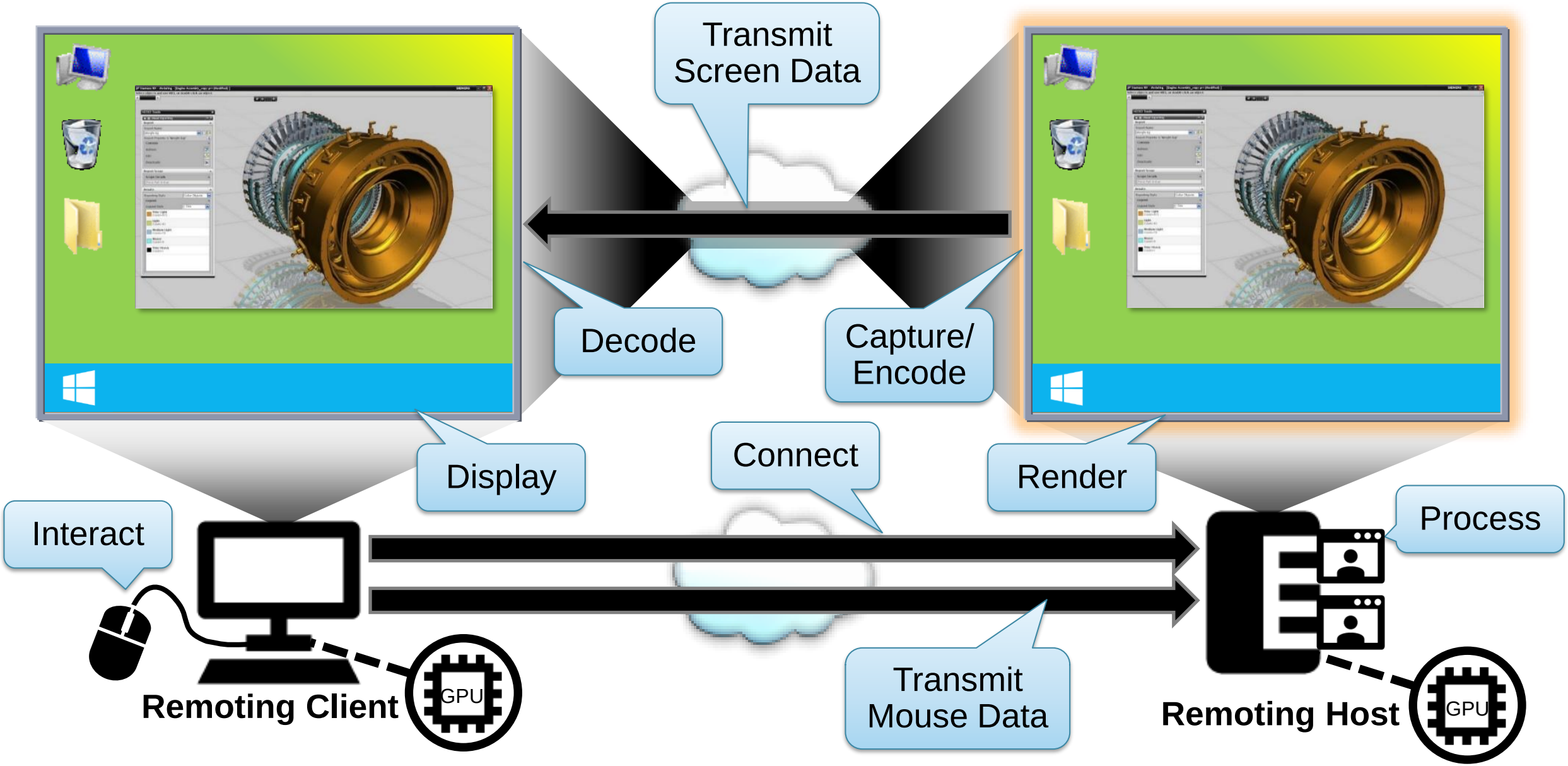
Tenant & Guest

DEX

“User Experience”

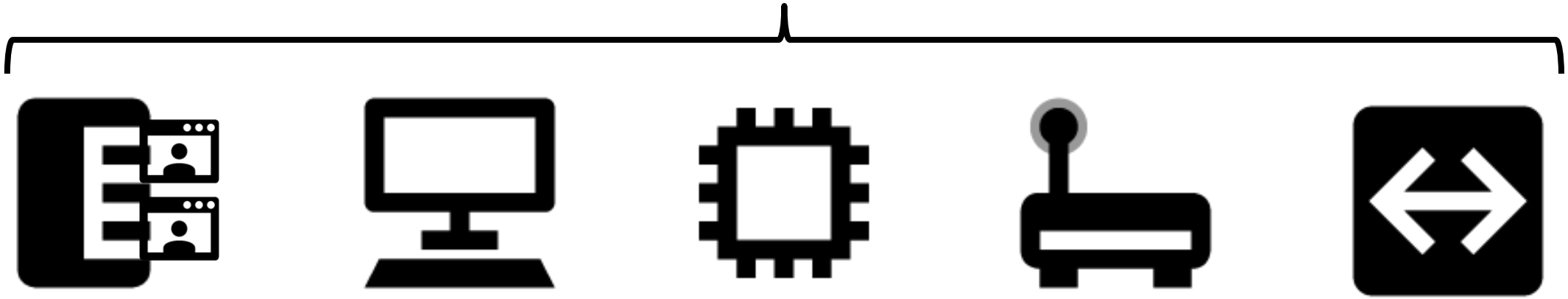
Soft Metrics

Hosting Windows in the Cloud



Cloud Windows User Experience Influencers

Only one inadequate factor can prevent a good perceived user experience



Host System
“VM Type”

Client Device
“Endpoint”

GPUs

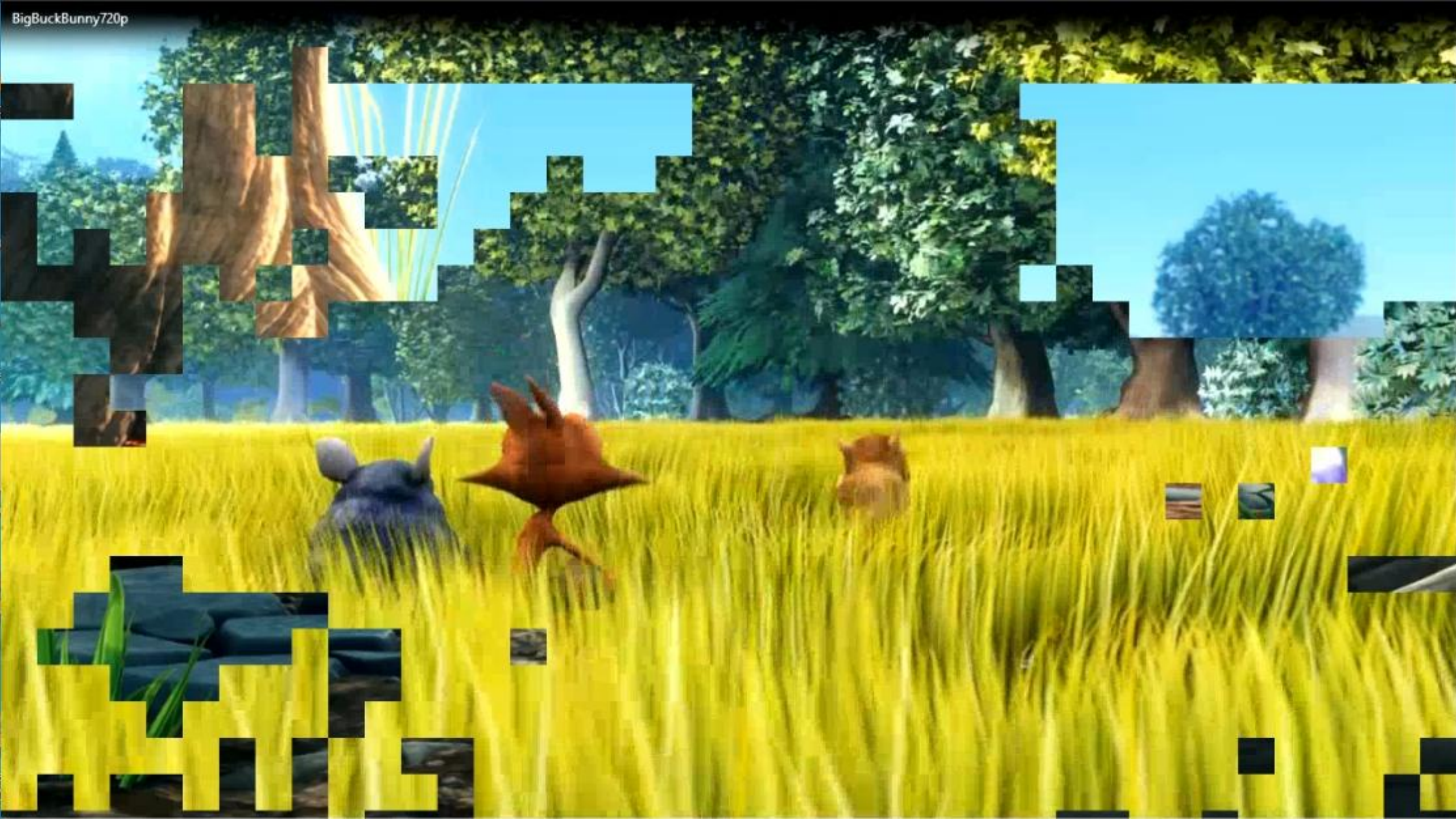
Network

- Bandwidth
- Latency
- Packet Loss

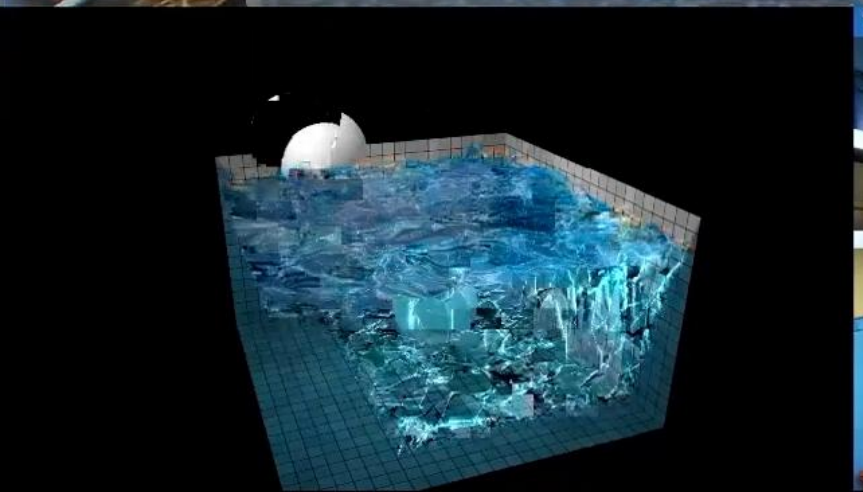
Remoting Protocol

DEX Screen Artifacts / Anomalies

- Block boundary – mosaicking, pixelating, quilting, checkerboarding
- Tiling, striping – rendering each section of an image grid, a tile, or a stripe separately
- Smear artifact – grime, smudge, airbrush effect
- Blurriness – out of focus, fuzziness, unsharpness
- Color artifacts – false colors, color bleeding
- Mosquito noise – edge busyness
- Ringing – echoing, ghosting
- Choppy – laggy, jumpy, jerky
- Floating – illusory motion in certain regions while the surrounding areas remain static
- Jitter – loss of transmitted data between network devices
- Flickering – fine-grain flickering and coarse-grain flickering
- Slow motion
- Video stuttering (“micro stutters”)
- Freeze frames


BigBuckBunny720p


Microsoft Edge
LEARN MORE
-GL
FISH
0
SOUNDS
ON
EANING
ABOUT




DO TOUCH GLASS!
FISH-GL
60

Remoting Protocol Features

Remoting protocols run on top of the Internet Protocol (IP), using Transmission Control Protocol (TCP), User Datagram Protocol (UDP) or a combination a TCP and UDP for different aspects of remoting. While older remoting protocols only used TCP, the modern ones use UDP for the graphics remoting aspect.

TCP is a connection-oriented protocol providing high reliability through error checking, congestion control and a built-in mechanism that rearranges data packets in the order specified. It also guarantees that all data remains intact in the packets transferred. But all this makes TCP relatively heavy-weight, significantly reducing graphics remoting performance on low bandwidth and high latency/packet loss networks.

[redacted]

[redacted] there is more [redacted] a remoting protocol, in particular when it comes to extensibility. The concept of virtual channels provides a way to establish separate streams of data communication while taking advantage of the remote session communication already established. Many remoting protocols use virtual channels to add functions that allow a strict separation from the core features or are not yet specified in the protocol. They represent a platform that future developments can be based on without having to modify the communication methods between host and clients. Examples for virtual channel use cases are joint client and server clipboards or redirecting print jobs to local client printers.

[redacted]

Client Side Rendering versus Host Side Rendering

In a graphics [redacted] environment, the Windows desktop including its applications is rendered in a


1920x1017
EUC Score for AWS
https://aws.amazon.com/
SL1-RollercoasterDX9
CPU
7% 2.11 GHz
Memory
3.8/15.9 GB (24%)
Disk 0 (C:)
SSD
0%
Ethernet
Ethernet 2
S: 0.1 R: 6.5 Mbps
GPU 0
Intel(R) HD Graphi...
0%
GPU 1
Radeon RX Vega ...
1% (47 °C)

Fishbowl

HTML5 Graphics Benchmark

10 Fish

Fish

10

Layers

- Water
- Frame
- Mask
- Back
- Fish
- Front
- Shine
- Shadow
- Audio
- Logo
- FPS
- Needle

We've learned a lot about user experience

But what makes users happy (or unhappy)?…

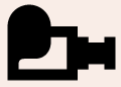
Three Ways to User Happiness (or not)

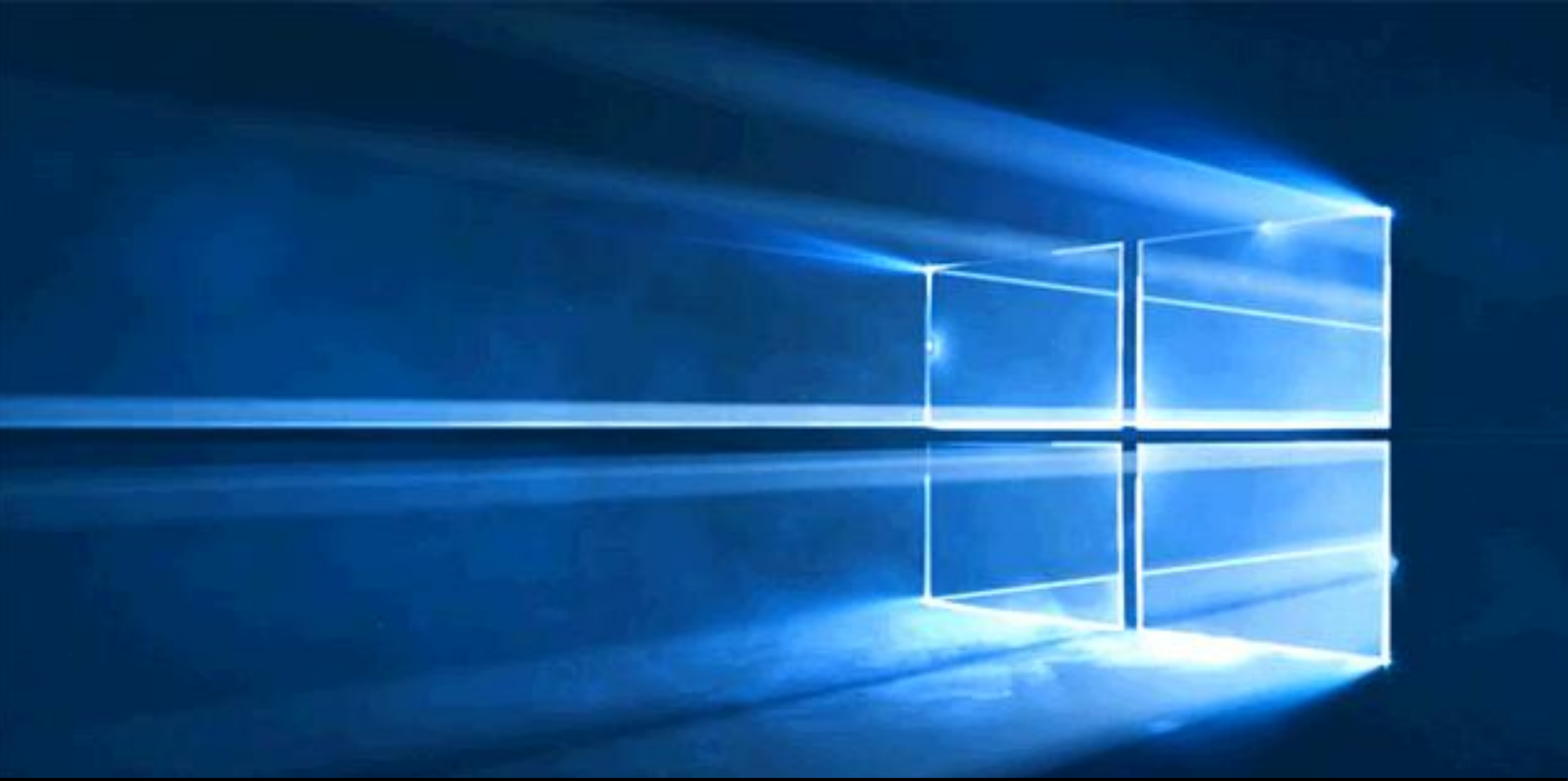
- **Not all users have the same requirements and expectations of VDI – and there is no “standard” user**
- **Even if the specifications seem to be identical, the user experience can differ drastically between physical and virtual machines**
- **Don't tell your users that network bandwidth is the only important factor for “good” VDI**

From a User's Perspective: EUC Quality Criteria

	**Boot and logon duration**	Measure boot time + logon time + user session load time until it is ready for user interaction. Includes identity management and authentication methods.
	**Application and content load time**	Measure time from user starting an application until the content appears and the application is ready for user input, including access to the storage system.
	**User input delay ("Lag")**	Measures responsiveness of graphical elements after user-initiated triggers = "time from mouse click to screen update" (lag, latency, system response time).
	**Graphics APIs supported**	Detect incompatibilities when running graphics applications using the DirectX, OpenGL, Vulkan and WebGL APIs.
	**Media formats supported**	Detect incompatibilities when opening and playing media files, such as MP4, MPEG, MOV, WMV or AVI.
	**Distortion of media**	Measure media and screen output quality. Detect image, animation, and audio/video compression and decompression artifacts and anomalies.
	**Screen refresh rate**	Measure the number of times per second that the desktop or application can draw consecutive images on the screen and in the host frame buffer (frames per sec = fps).
	**Endpoint specs and quality**	Determine the screens' number of pixels, density, and visual dimensions – frame buffer requirements grow with resolution and screen number. Detect periphery incompatibilities.
	**Application reliability and stability**	Detect application hangs, freezes, crashes or unhandled exceptions. Measure consistency, dependability and robustness of applications.
	**Session consistency and resilience**	Check if user state is preserved across subsequent sessions. Measure session disruptions, hangs, disconnects/reconnects, availability, timeouts and redundancy.

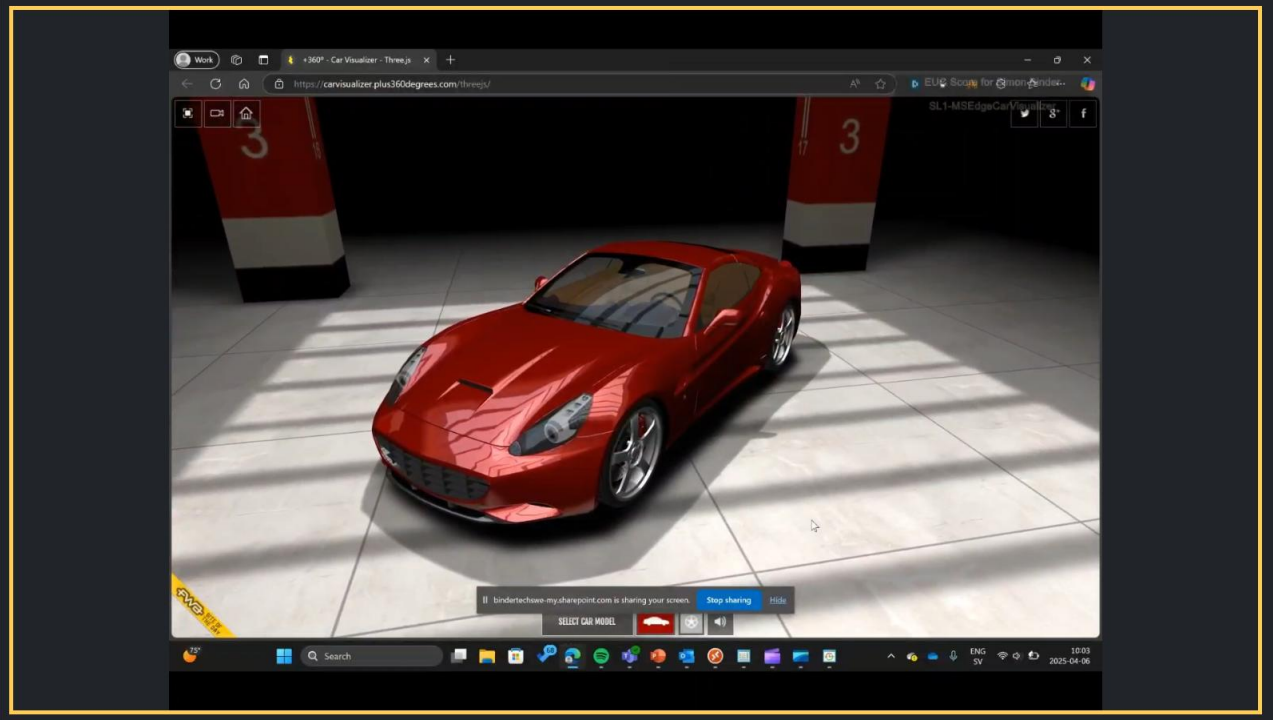
Personas, Requirements & VM Types

	Persona Name	VM Specs	Network	VM Type Examples
	**Task Worker**	CPU 2-4 vCPUs Memory minimum of 2GB GPU no	Bandwidth low Latency 0-200ms Packet loss 0-2%	Win365 Basic or Standard Azure D2s_v5, D2ads_v5
	**Information Worker**	CPU 2-4 vCPUs Memory minimum of 4GB GPU no	Bandwidth low Latency 0-100ms Packet loss 0-1%	Win365 Standard or Premium Azure D4s_v5, D4ads_v5
	**Knowledge Worker**	CPU 4-8 vCPUs Memory minimum of 8GB GPU no or shared	Bandwidth medium Latency 0-50ms Packet loss 0-0.5%	Win365 Premium or GPU Standard Azure D8s_v5, D8ads_v5 NG8ads_V620_v1
	**Power User**	CPU 4-16 vCPUs Memory minimum of 16GB GPU shared or dedicated	Bandwidth medium Latency 0-50ms Packet loss 0-0.1%	Win365 Premium+ or GPU Standard Azure D16s_v5, D16ads_v5 NG16ads_V620_v1, NC4as_T4_v3
	**CAD/CAM Designer**	CPU 8-16 vCPUs Memory minimum of 16GB GPU high-end	Bandwidth high Latency 0-20ms Packet loss 0%	Win365 GPU Super or GPU Max Azure NG16ads_V620_v1 NC8as_T4_v3, NC16as_T4_v3
	**Media Designer**	CPU 8-16 vCPUs Memory minimum of 16GB GPU high-end	Bandwidth very high Latency 0-30ms Packet loss 0%	Win365 GPU Super or GPU Max Azure NG16ads_V620_v1 NC16as_T4_v3, NC16as_T4_v3

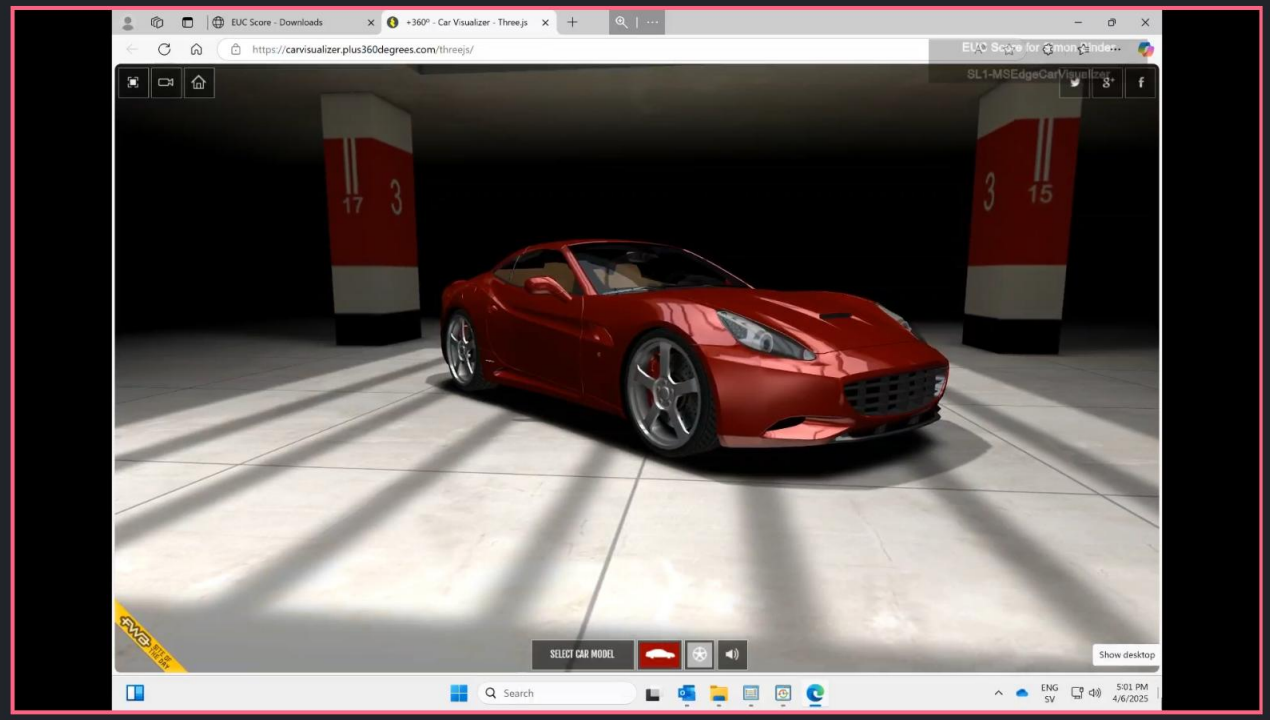


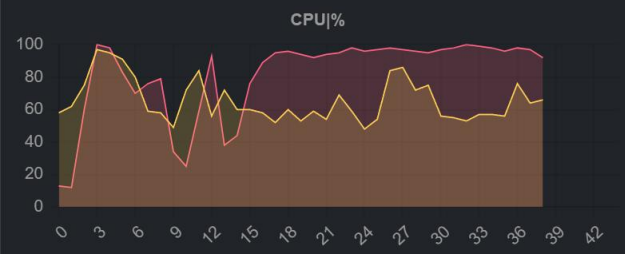
Show Time

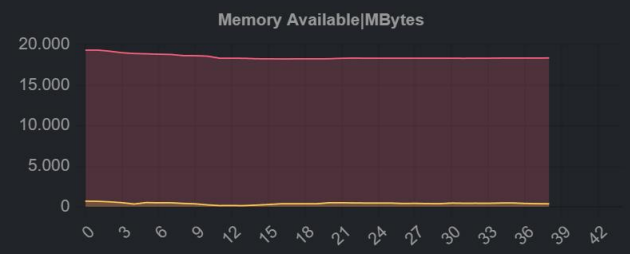
SL1-MSEdgeCarVisualizer on Surface Pro X

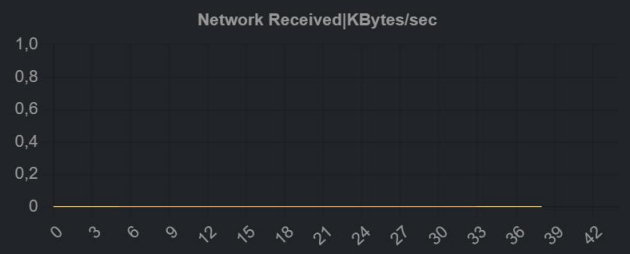


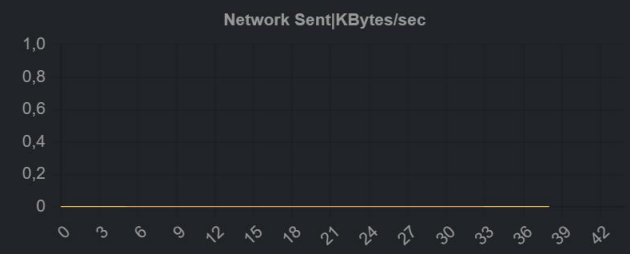
SL1-MSEdgeCarVisualizer on AVD

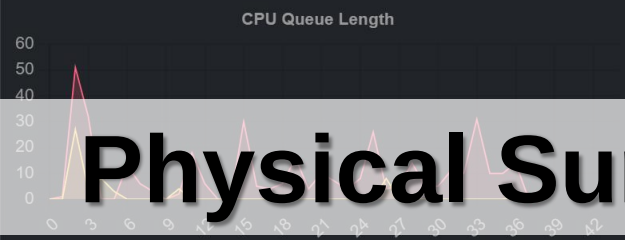


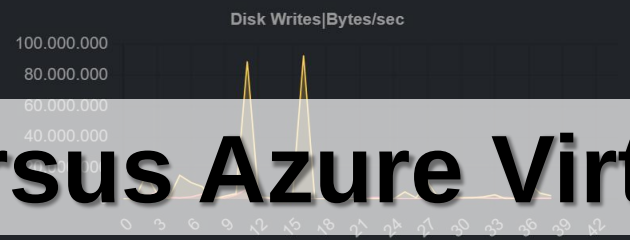


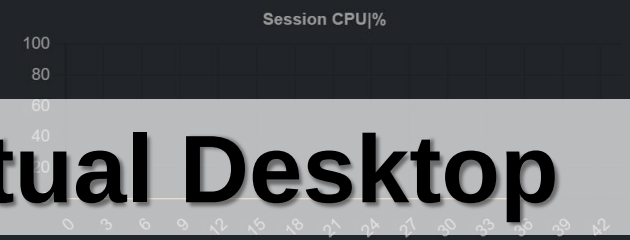






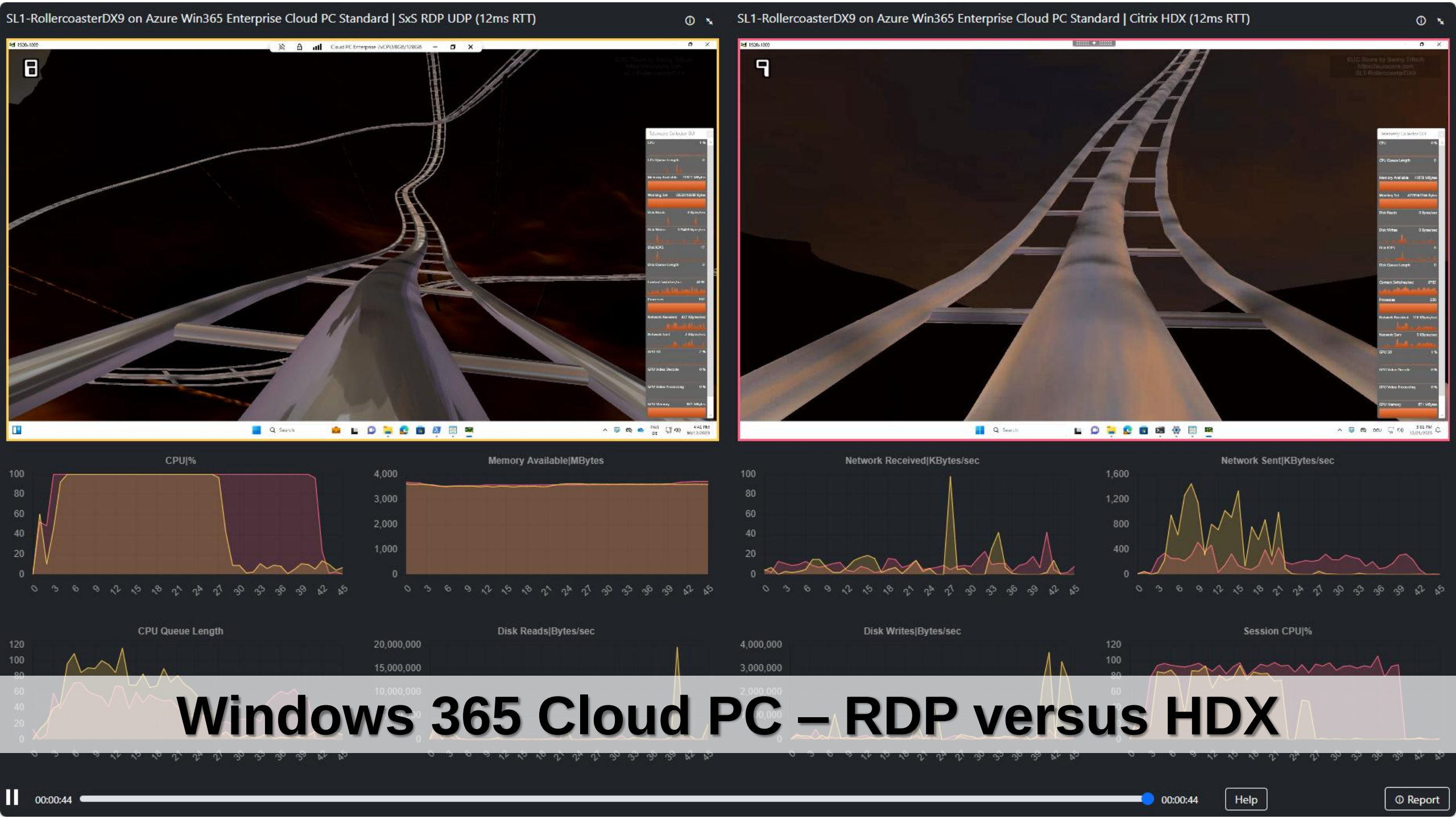


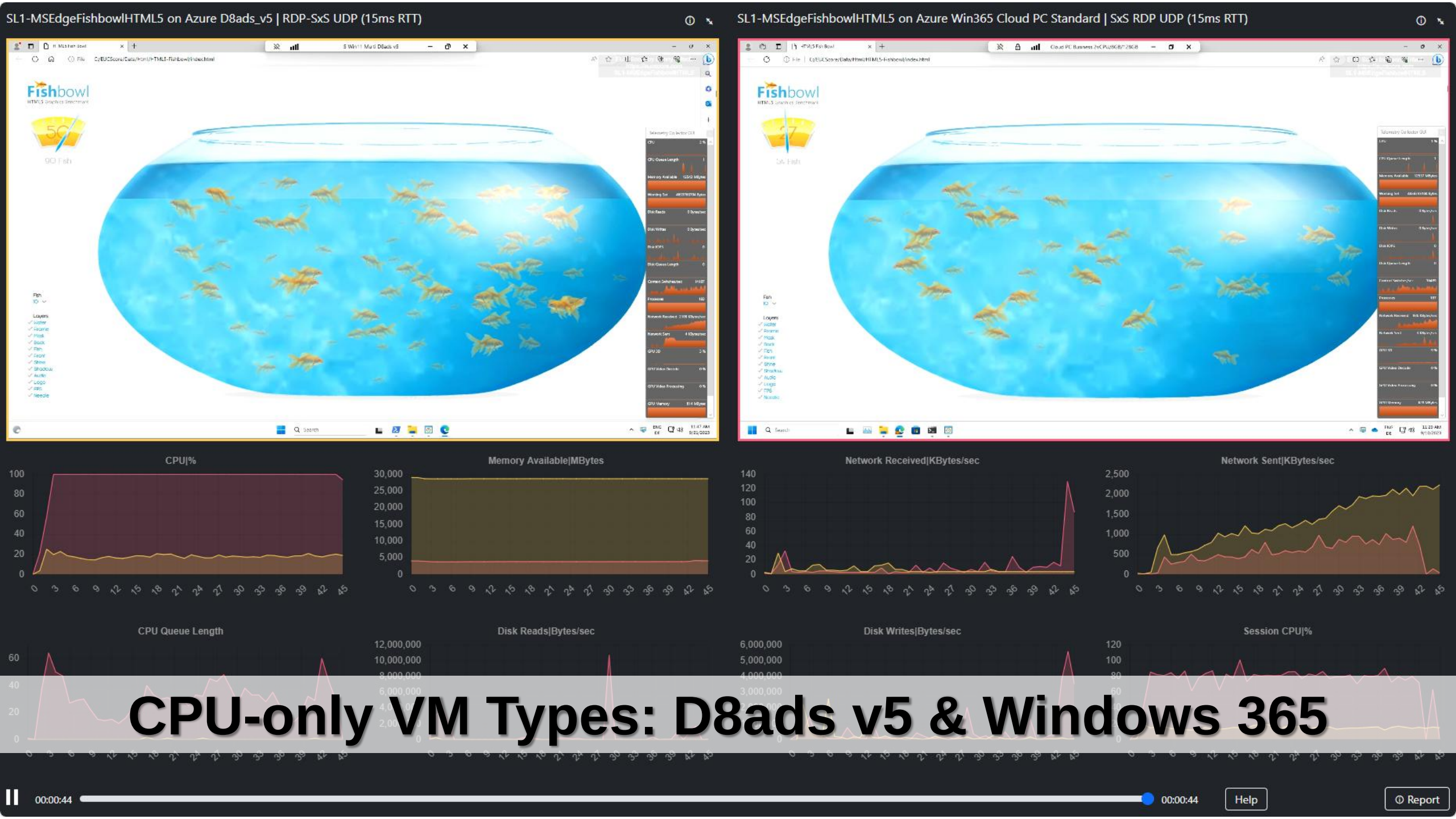


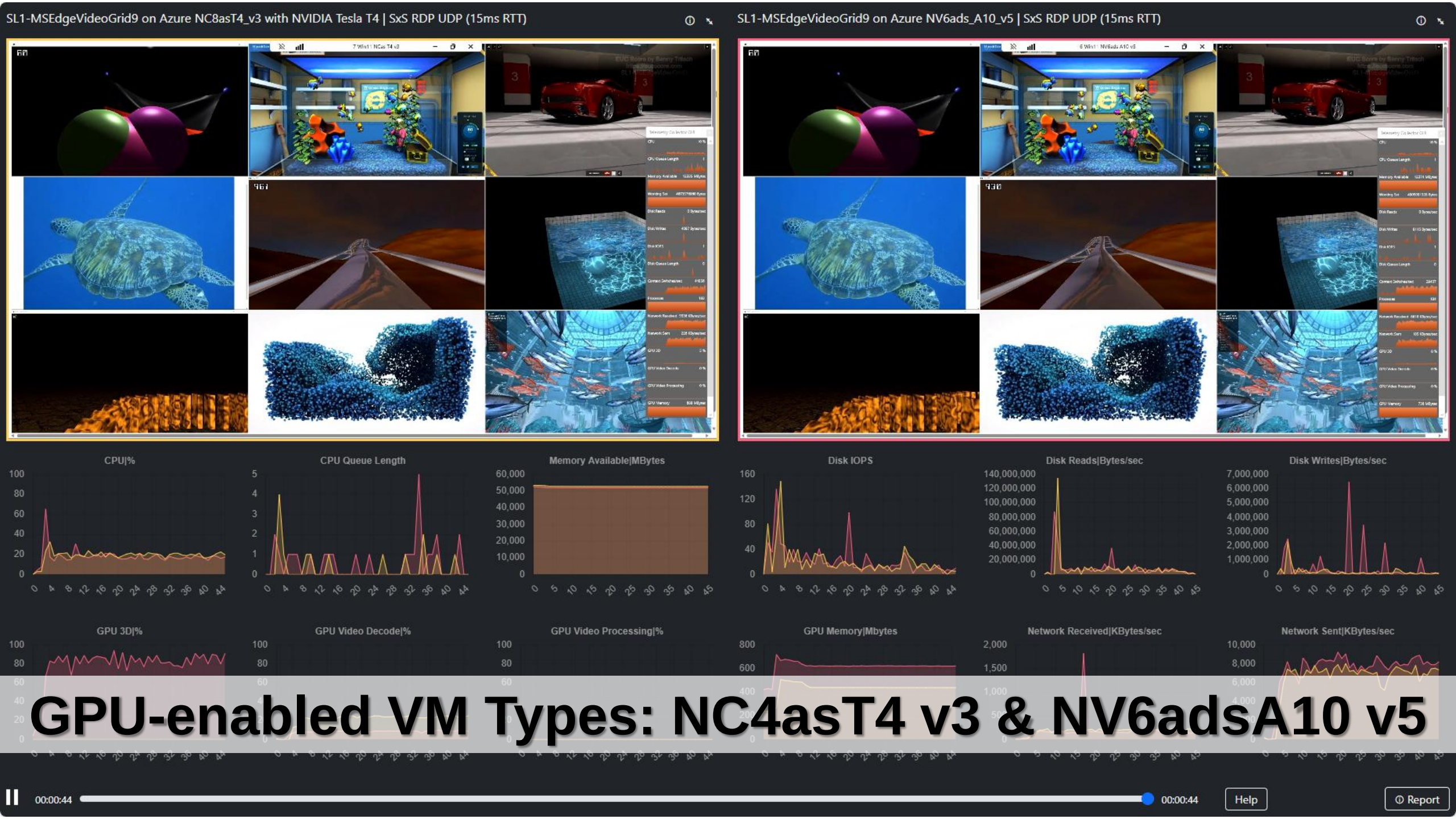


Physical Surface Pro X versus Azure Virtual Desktop

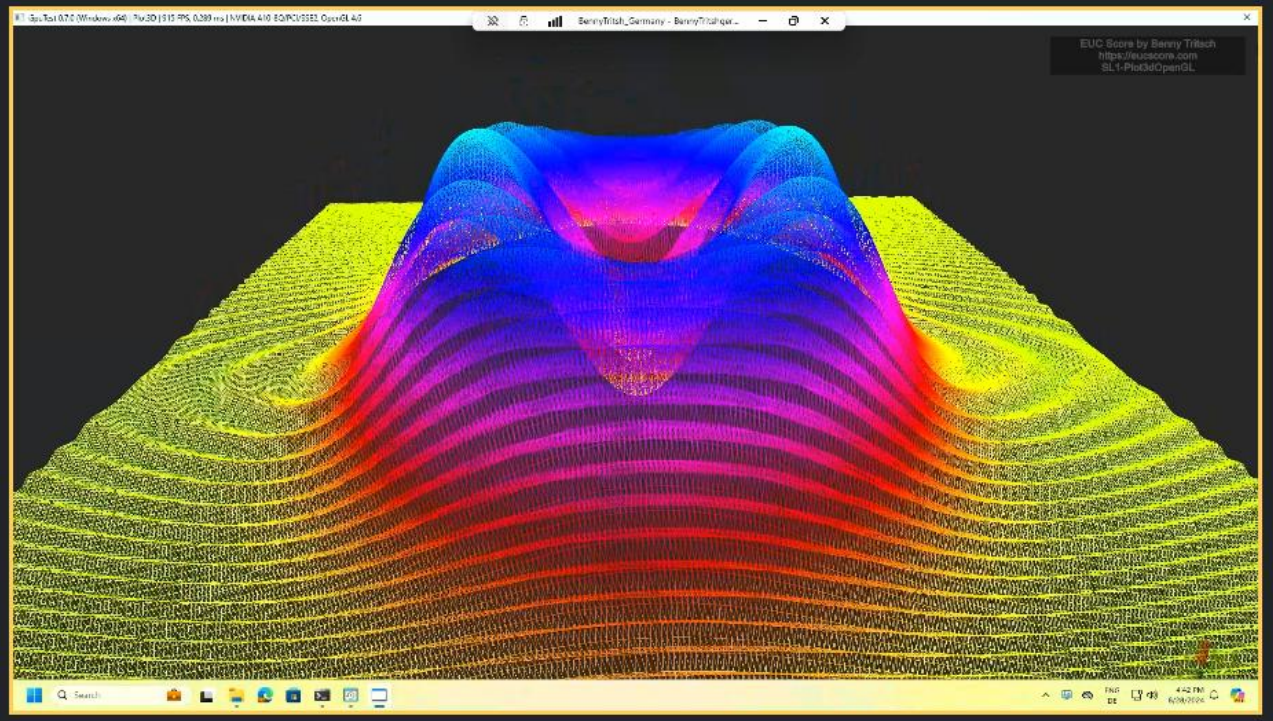
00:00:39 00:00:45 Help Report


SL1-RollercoasterDX9 on Azure Win365 Enterprise Cloud PC Standard | SxS RDP UDP (12ms RTT)
SL1-RollercoasterDX9 on Azure Win365 Enterprise Cloud PC Standard | Citrix HDX (12ms RTT)
CPU|%
Memory Available|MBytes
Network Received|KBytes/sec
Network Sent|KBytes/sec
CPU Queue Length
Disk Reads|Bytes/sec
Disk Writes|Bytes/sec
Session CPU|%
Windows 365 Cloud PC – RDP versus HDX
00:00:44
00:00:44
Help
Report


SL1-MSEdgeFishbowlHTML5 on Azure D8ads_v5 | RDP-SxS UDP (15ms RTT)
SL1-MSEdgeFishbowlHTML5 on Azure Win365 Cloud PC Standard | SxS RDP UDP (15ms RTT)
Fishbowl
CPU|%
Memory Available|MBytes
Network Received|KBytes/sec
Network Sent|KBytes/sec
CPU Queue Length
Disk Reads|Bytes/sec
Disk Writes|Bytes/sec
Session CPU|%
CPU-only VM Types: D8ads v5 & Windows 365
00:00:44
00:00:44
Help
Report

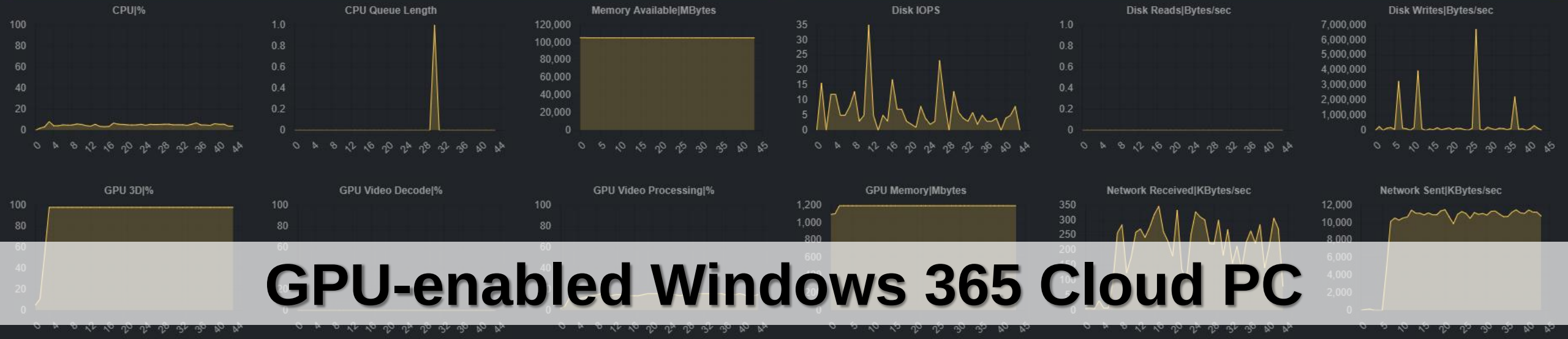

SL1-MSEdgeVideoGrid9 on Azure NC8asT4_v3 with NVIDIA Tesla T4 | SxS RDP UDP (15ms RTT)
SL1-MSEdgeVideoGrid9 on Azure NV6ads_A10_v5 | SxS RDP UDP (15ms RTT)
CPU|%
CPU Queue Length
Memory Available|MBytes
Disk IOPS
Disk Reads|Bytes/sec
Disk Writes|Bytes/sec
GPU 3D|%
GPU Video Decode|%
GPU Video Processing|%
GPU Memory|Mbytes
Network Received|KBytes/sec
Network Sent|KBytes/sec
GPU-enabled VM Types: NC4asT4 v3 & NV6adsA10 v5
00:00:44
00:00:44
Help
Report

SL1-Plot3dOpenGL on Azure Windows 365 Enterprise GPU Standard | SxS RDP UDP (10ms RTT)



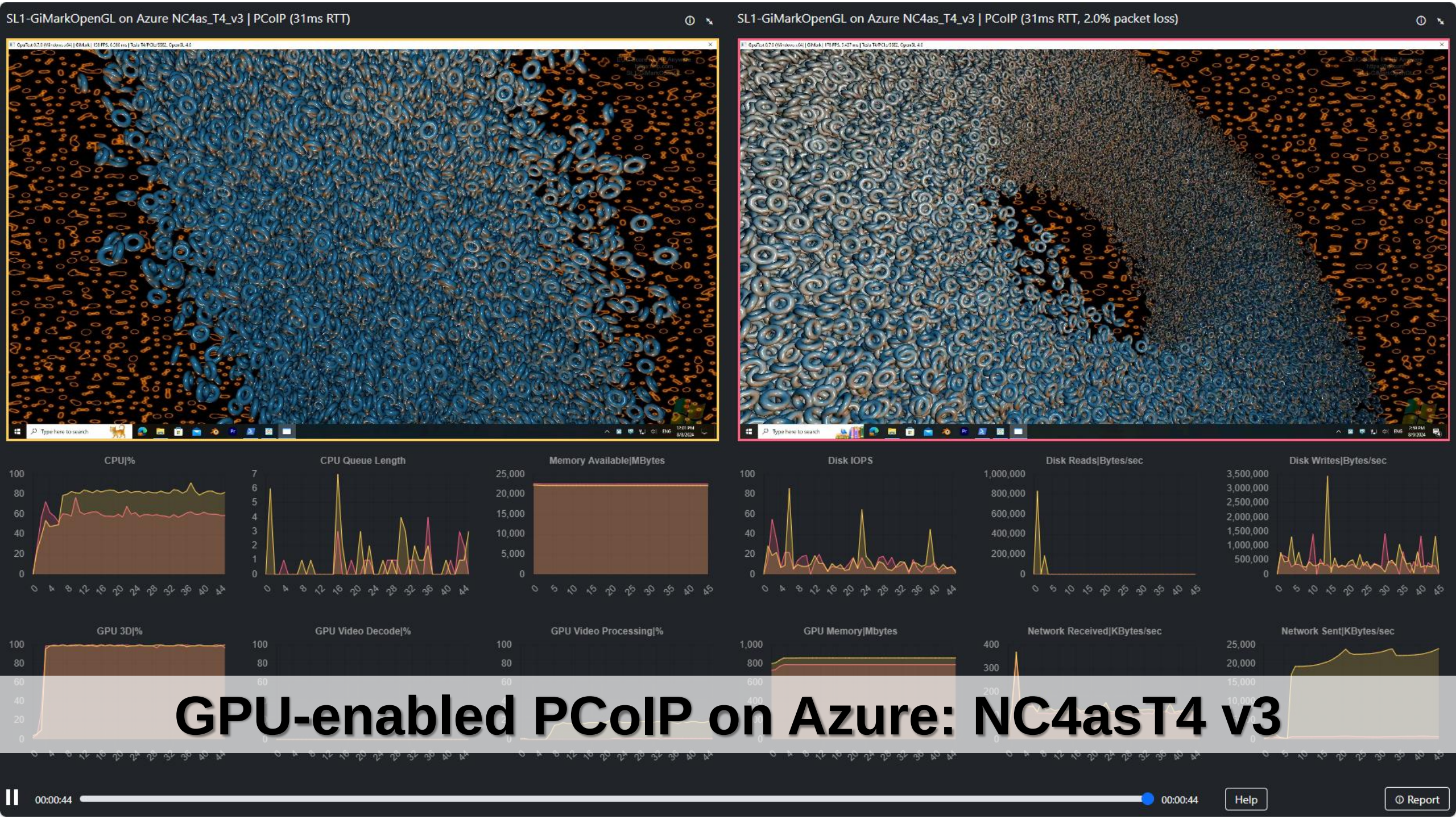
SL1-Plot3dOpenGL on Azure Windows 365 Enterprise GPU Standard | SxS RDP UDP (10ms RTT)

```
00:00:00.000  Date: 2024/08/28 | Time: 16:42:14.717 | AppName: GpuTest.exe
00:00:00.000  Simload: SL1-Plot3dOpenGL | Computername: CPC-Benny-Y7UNR | Username: BennyTritshgermany
00:00:00.000  Number of Monitors: 1 | Default Monitor: 1 (0 | 0 | 1920 | 1080)
00:00:00.000  Pre-Simload countdown screen was visible for 1 sec
00:00:00.000  Delay between Simload start time and activity log start time: 1.093 sec
00:00:01.684  App launch time: 578 ms
00:00:01.947  Run action initiated
```

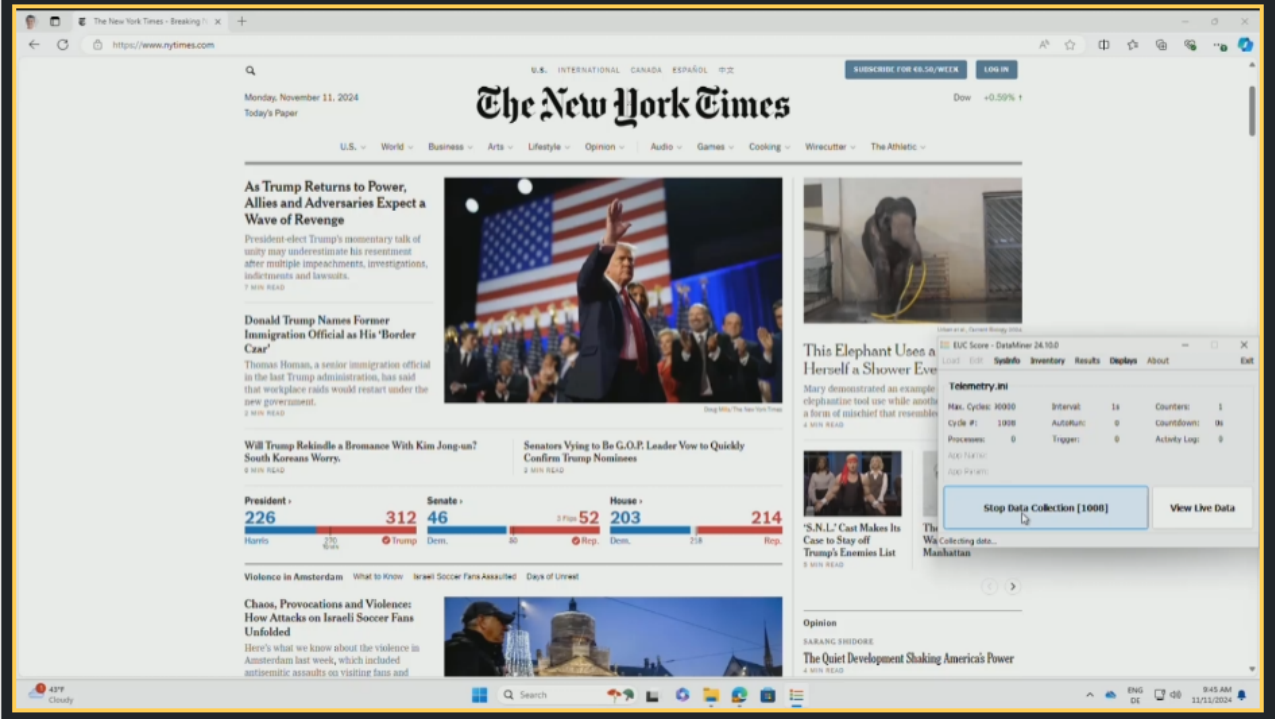


GPU-enabled Windows 365 Cloud PC

00:00:43 00:00:45 Help Report

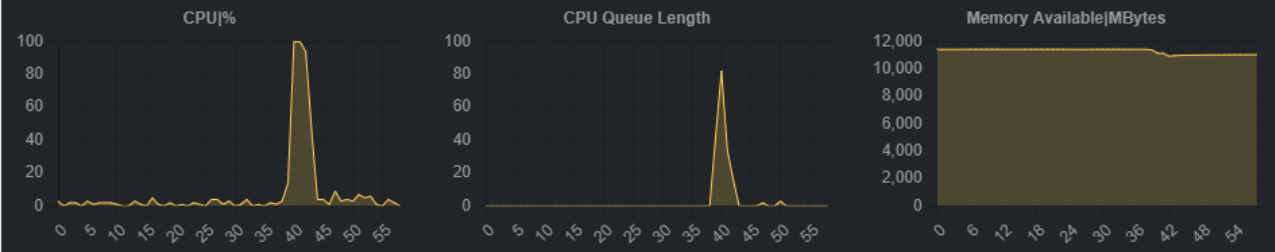

SL1-GiMarkOpenGL on Azure NC4as_T4_v3 | PCoIP (31ms RTT)
SL1-GiMarkOpenGL on Azure NC4as_T4_v3 | PCoIP (31ms RTT, 2.0% packet loss)
CPU|%
CPU Queue Length
Memory Available|MBytes
Disk IOPS
Disk Reads|Bytes/sec
Disk Writes|Bytes/sec
GPU 3D|%
GPU Video Decode|%
GPU Video Processing|%
GPU Memory|Mbytes
Network Received|KBytes/sec
Network Sent|KBytes/sec
GPU-enabled PCoIP on Azure: NC4asT4 v3
00:00:44
00:00:44
Help
Report

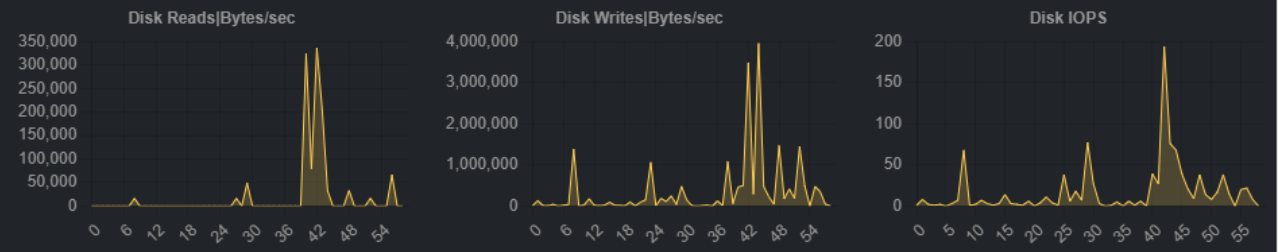
Screen: User reconnects from Windham device to Cloud PC | Time disconnected: 15-20 minutes

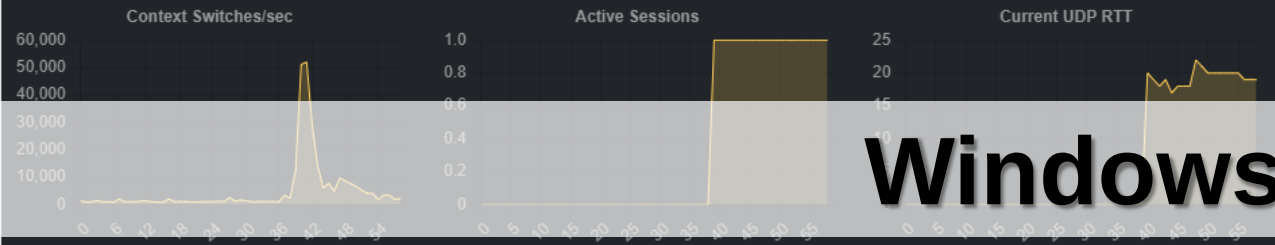


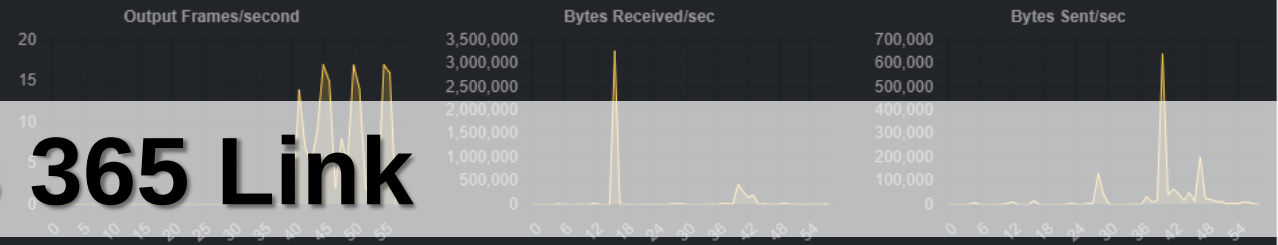
Activities: User reconnects from Windham device to Cloud PC | Time disconnected: 15-20 minutes

00:00:00.000	Date: 2024/11/11
00:00:00.000	Time: 09:44:16
00:00:00.000	Client device: Windham
00:00:00.000	Computername: CPC-btrit-BZZW6
00:00:00.000	Username: BernhardTritsch
00:00:00.000	Sign in with work account
00:00:16.520	Enter password
00:00:25.400	Approve sign in request
00:00:37.140	Connecting to your Cloud PC
00:00:40.500	Session reconnected (black frame)
00:00:40.500	Welcome screen
00:00:40.570	Desktop visible
00:00:40.590	Browser content visible
00:00:41.430	Location override popup appears
00:00:46.490	Start menu closed by user
00:00:47.430	Location override popup disappears





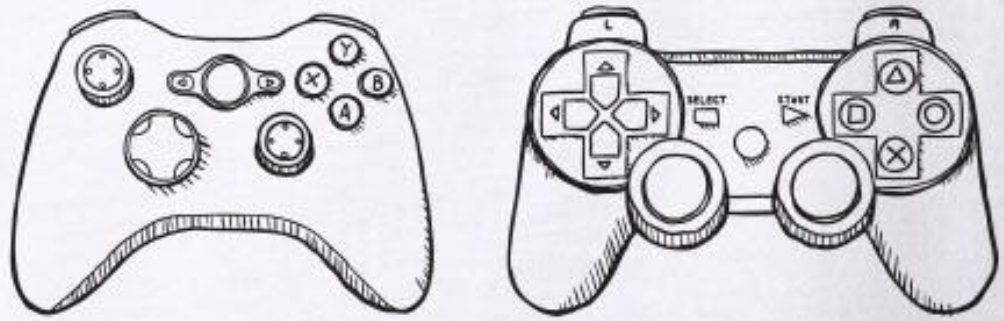




Windows 365 Link

00:00:59 00:01:00 Help Report

VIDEO GAMES DON'T MAKE US VIOLENT



LAG DOES

Conclusion

- Don’t walk in the dark: Test labs and POCs are your friends
  - **Identify personas** based on app and user requirements
  - **Check VM specs** and assign personas to the right VM type
  - **Analyze network constraints** and adapt the Cloud Windows setup
- Ask simple and clearly defined questions that can be answered by experiments (the “MythBusters” principle)
- Both quantitative (= scores) and qualitative data are the prerequisite for rating user happiness
- Human intervention is an integral part of the rating process
  - Inform selected users regularly about the status and listen to them

Call to Action

If you want to learn more about EUC Score, send me an email

info@eucscore.com

https://eucscore.com
https://eucscore.com/results

NOTE: The EUC Score toolset is free for community benchmarking tests when the results are made freely available to the public

EUC Score Links

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- Simload Gallery: https://eucscore.com/gallery.html
- Test Results (Sync Player): https://eucscore.com/results
- Terminology (Glossary): https://eucscore.com/terminology.html
- Lab Equipment: https://eucscore.com/equipment.html

Thank You

Benny Tritsch | info@eucscore.com