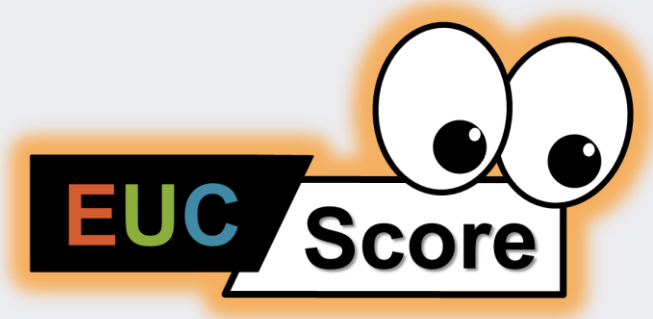


>< AVD TECH FEST

hosted by control UP

Microsoft nerdio citrix IGEL LOGINVSI 10ZiG ezeep by ThinPrint numecent UltraArmor

EUC Score

2025 AVD TECH FEST

hosted by control up

Turbocharge Your Cloud Desktops: The Many Shades of VDI User Experience

Dr. Benny Tritsch | Independent Performance Data Scientist

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

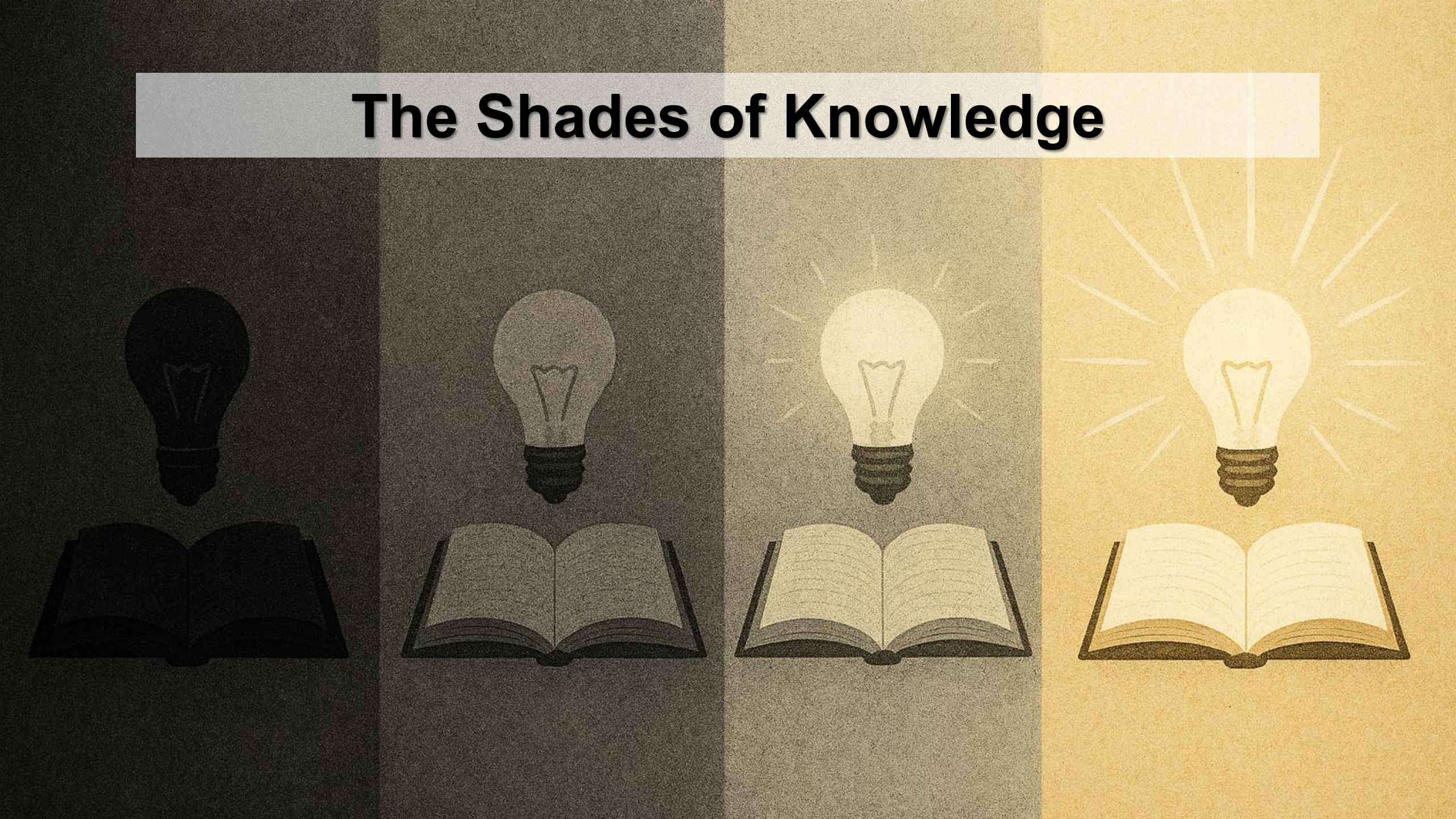
NVIDIA Advisor NVIDIA Enterprise Platform | omnissa TECH INSIDER | NERDIO VALUED PROFESSIONAL | MVP Microsoft Most Valuable Professional | VIPP Very Important Parallels Professional Parallels

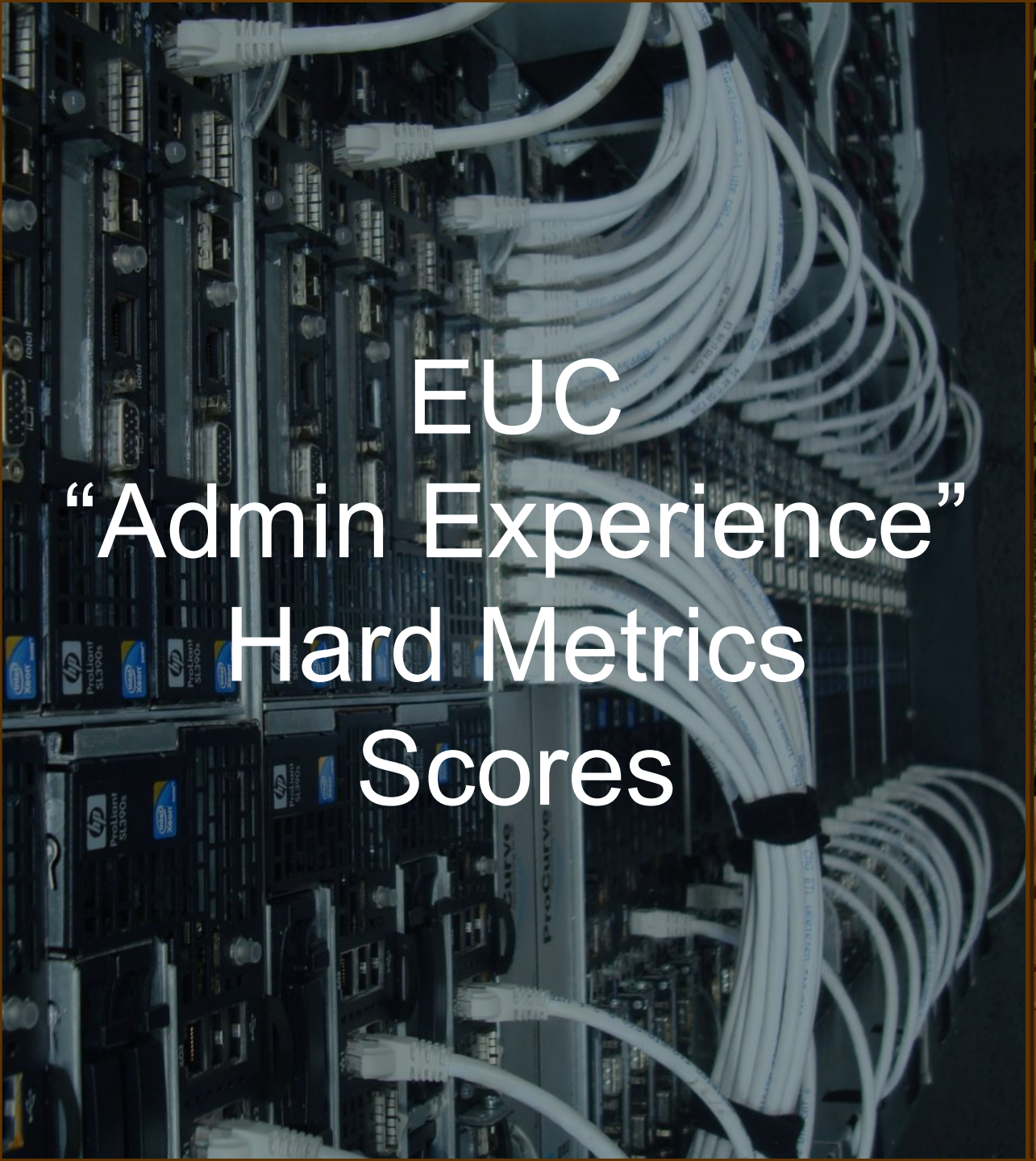
Microsoft | nerdio | citrix | IGEL | LOGINVSI | 10ZiG | ezeep by ThinPrint | numecent | UltrArmor


CLOUD PC
Security
Flexibility
Management
Cost


Admin: From Expert to Generalist

The Shades of Knowledge



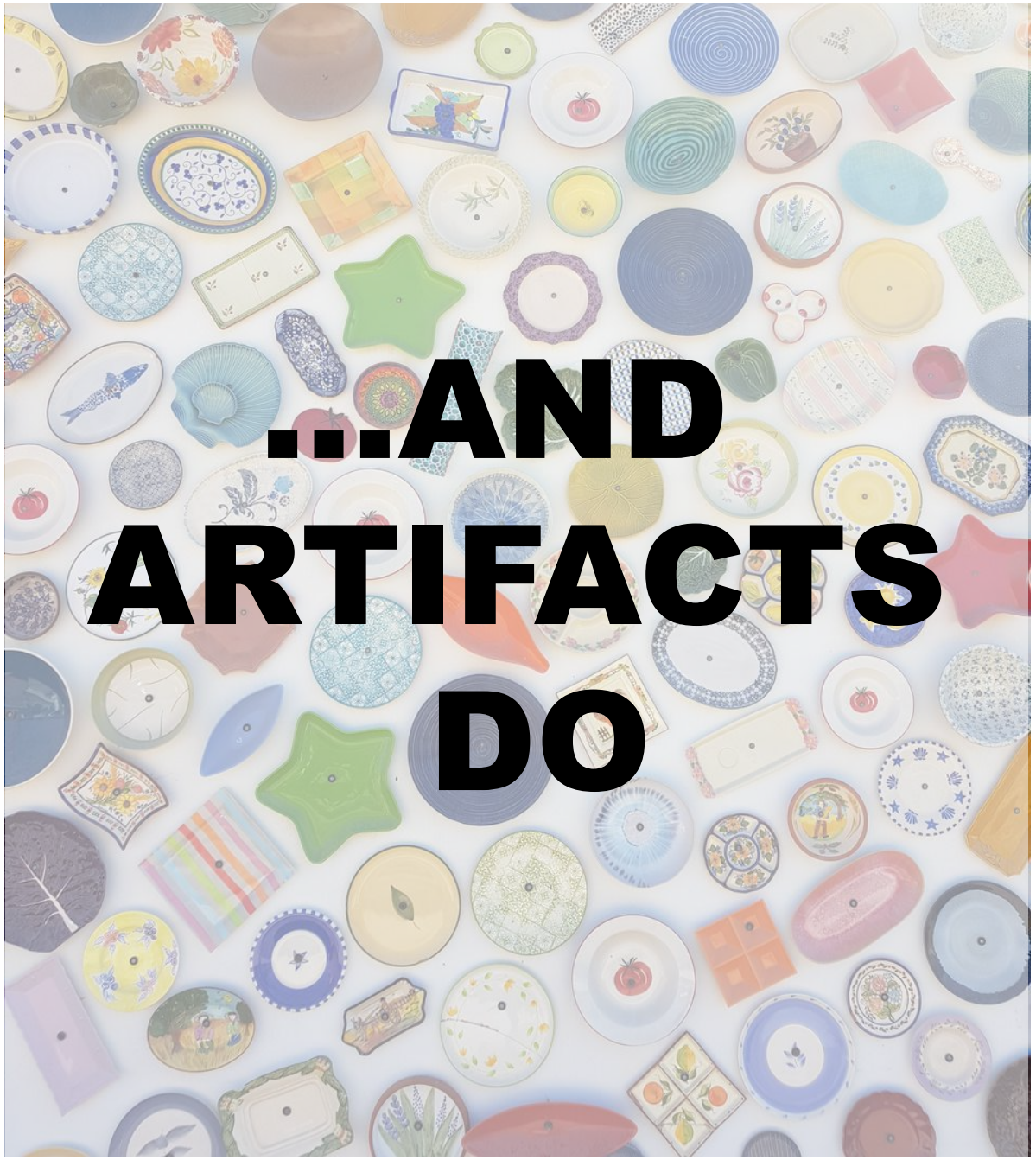


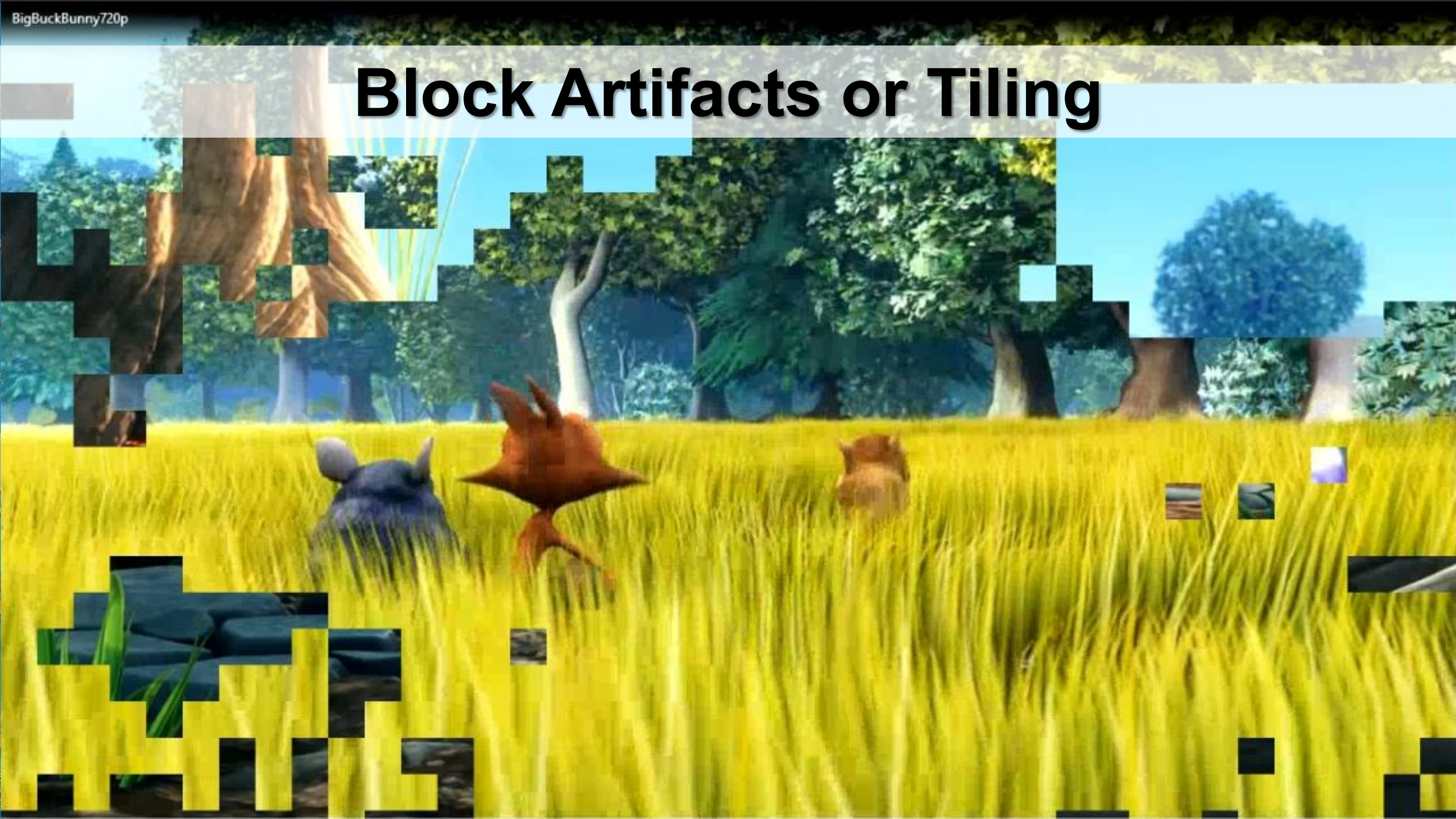
EUC
“Admin Experience”
Hard Metrics
Scores

DEX
“User Experience”
Soft Metrics
Shades

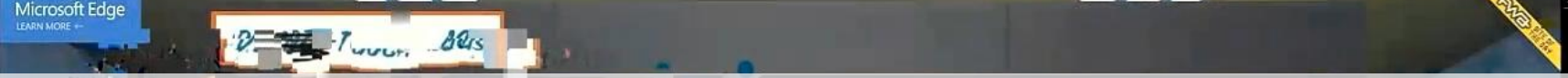
What Can Go Wrong?
The Many Shades of User Experience

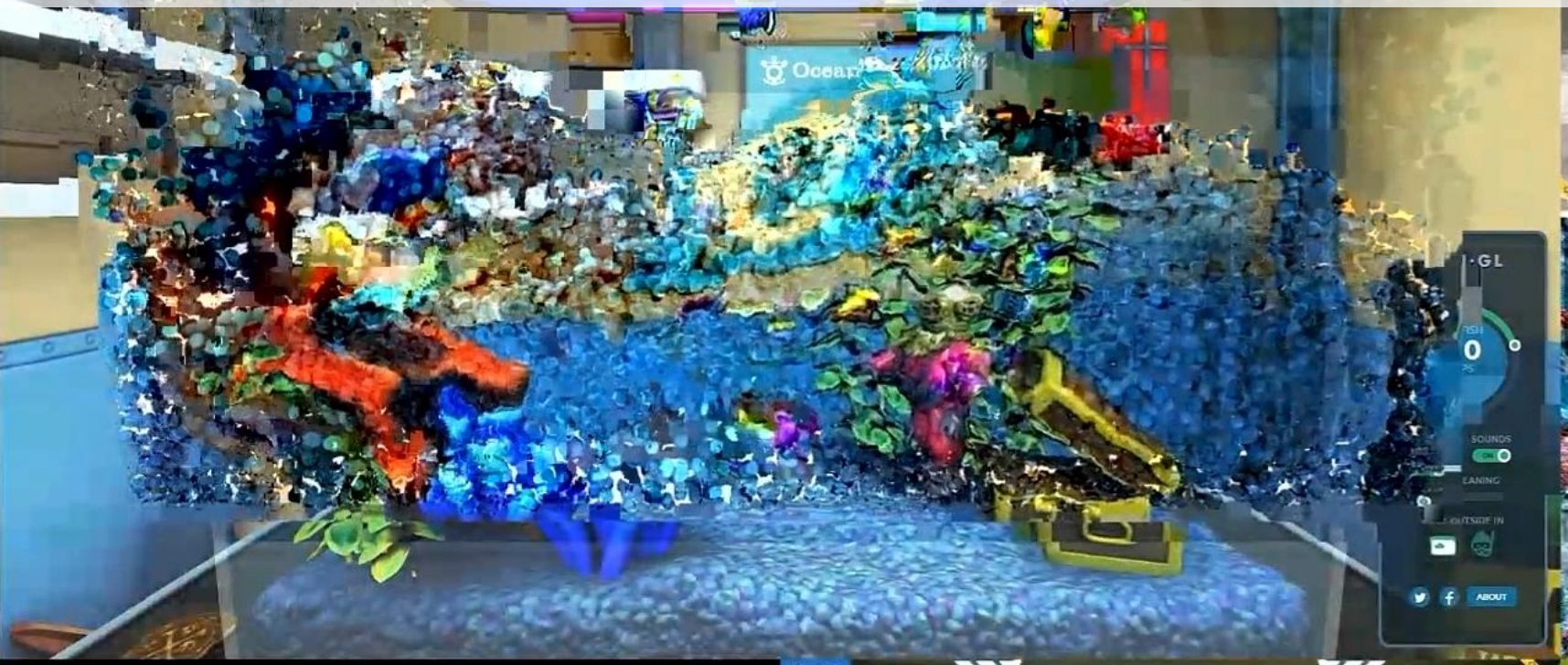

VIDEO GAMES
DON'T MAKE
US VIOLENT
LAG DOES

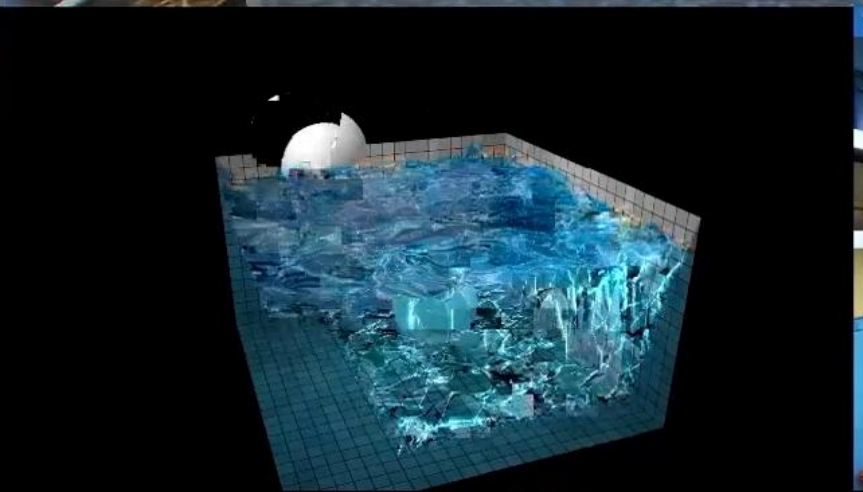

...AND
ARTIFACTS
DO

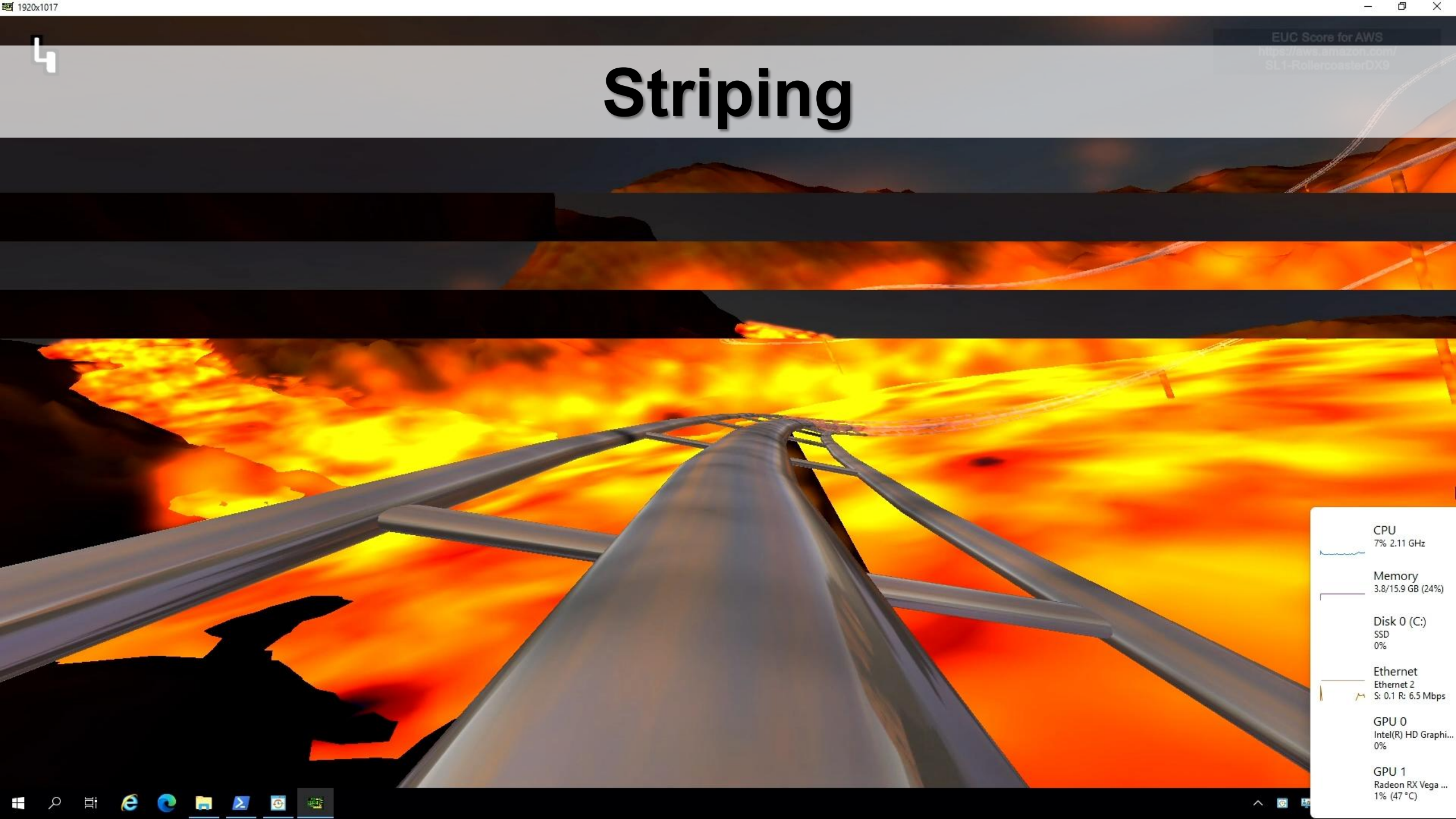

BigBuckBunny720p
Block Artifacts or Tiling

Smear Artifacts (Airbrush Effect)

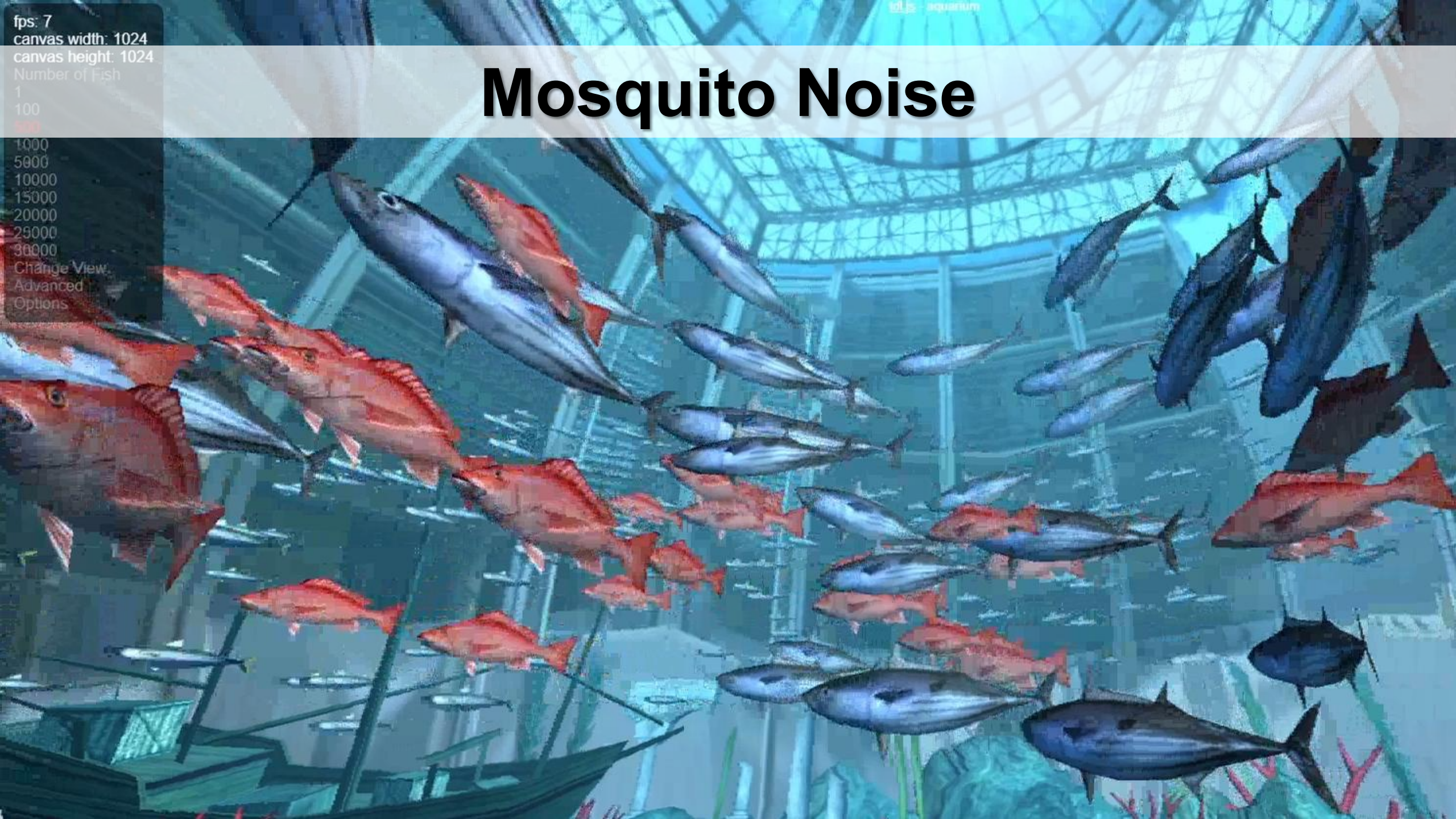







1920x1017
EUC Score for AWS
https://aws.amazon.com/
SL1-RollercoasterDX9
Striping
CPU
7% 2.11 GHz
Memory
3.8/15.9 GB (24%)
Disk 0 (C:)
SSD
0%
Ethernet
Ethernet 2
S: 0.1 R: 6.5 Mbps
GPU 0
Intel(R) HD Graphi...
0%
GPU 1
Radeon RX Vega ...
1% (47 °C)

Blurriness



Mosquito Noise

Color Artifacts (CLUT)

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.

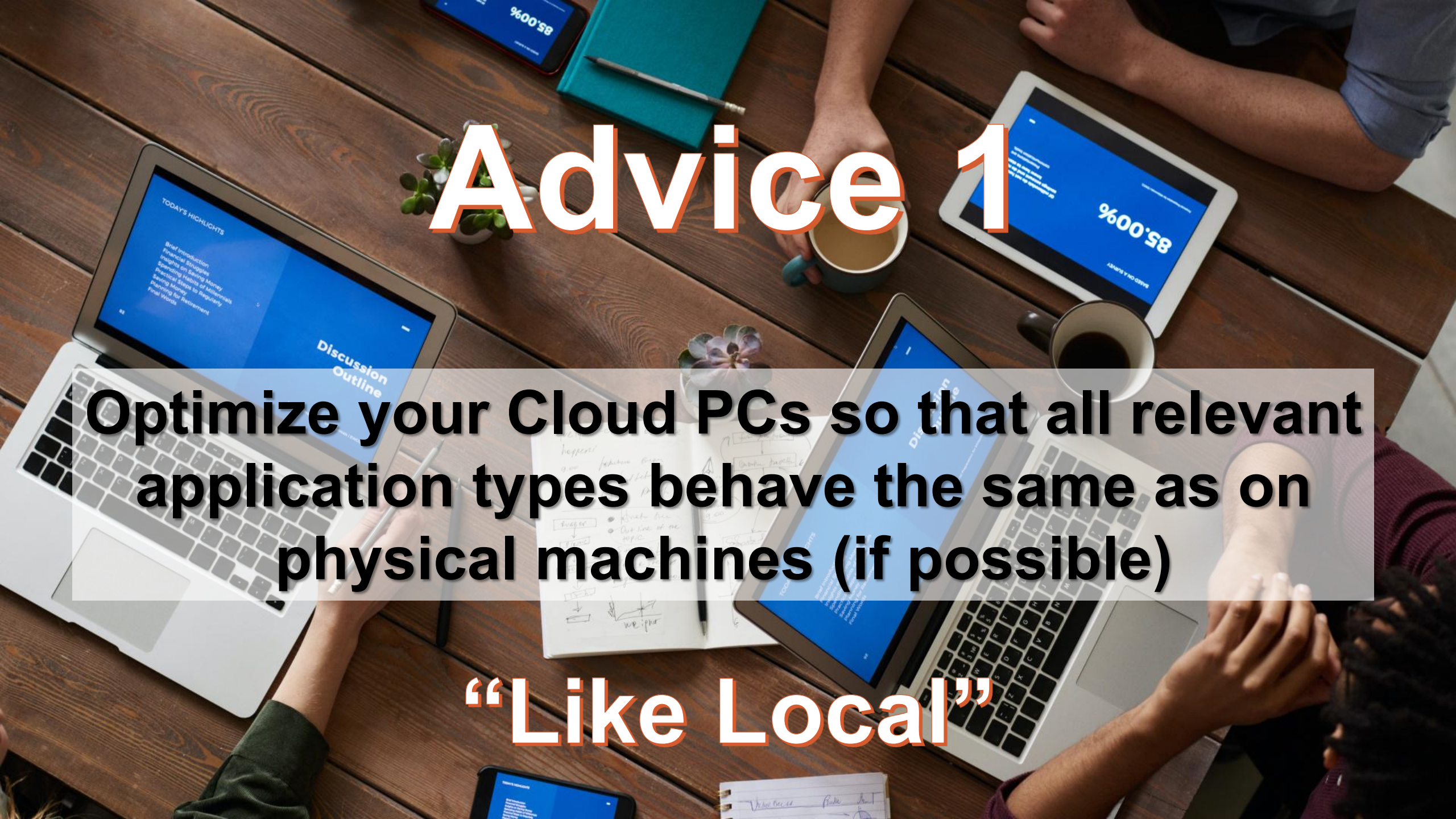
[redacted]

[redacted]

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

Motion Screen Artifacts / Anomalies

- Choppy, laggy, jumpy, jerky, stuttering (“micro stutters”) – the motion appears uneven, irregular, or discontinuous
- Jitter – loss of transmitted image or video data
- Freeze frame – a single frame forming a motionless image from a video
- Slow motion – playing back video more slowly than it was made or recorded
- Ringing, echoing, ghosting – a repeating pattern of lines or waves that appear around sharp corners and edges
- Floating – illusory motion in certain regions while the surrounding areas remain static
- Flickering – fine-grain flickering and coarse-grain flickering



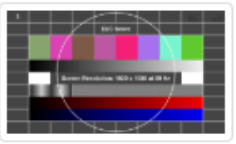
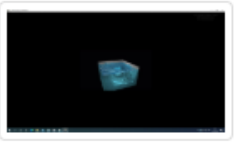
Advice 1

Optimize your Cloud PCs so that all relevant application types behave the same as on physical machines (if possible)

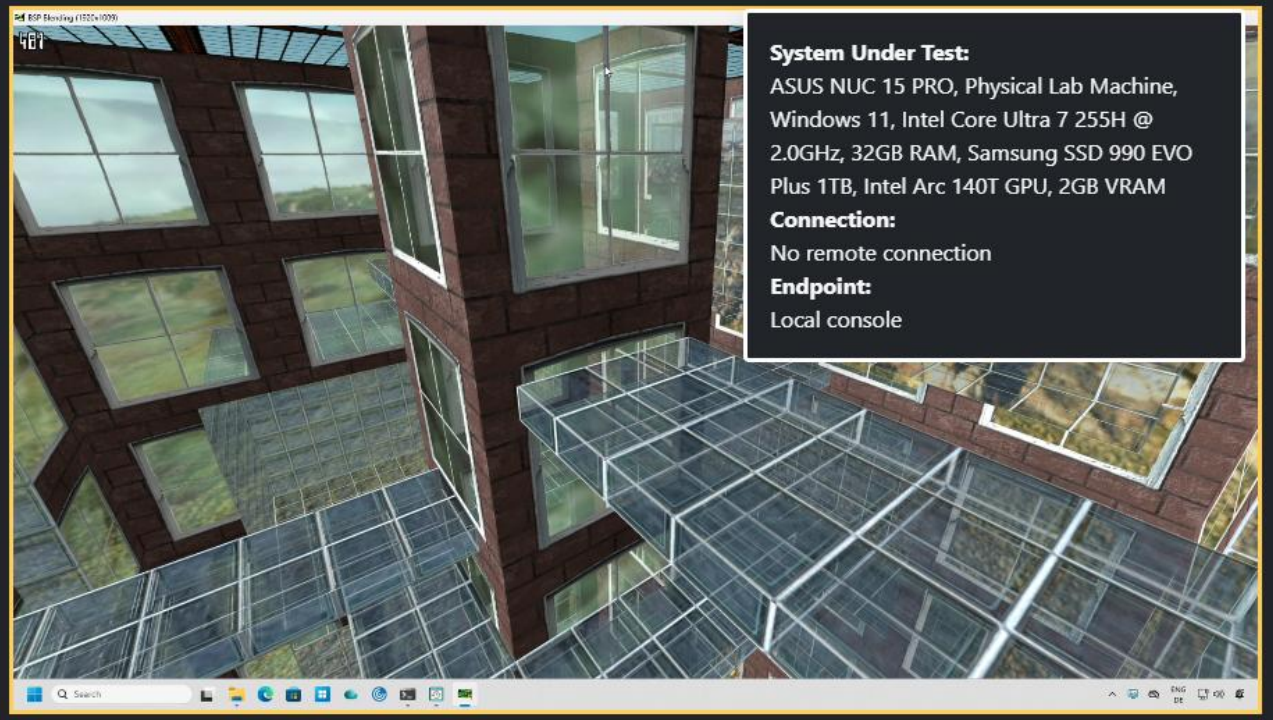
“Like Local”

Workloads representing different app types

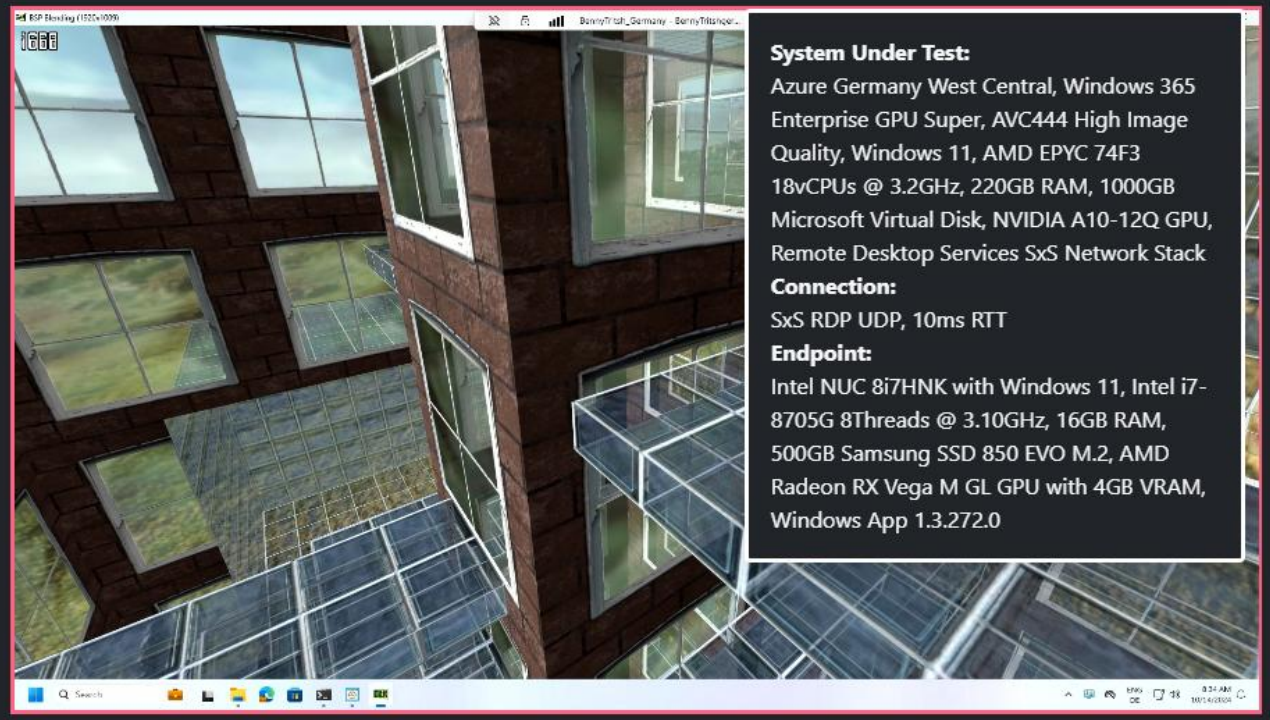
https://eucscore.com/gallery

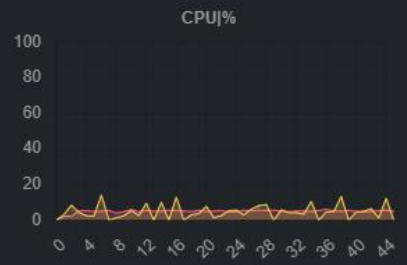
Thumbnail	Simload Type	Description
	**System** Light user type SL0-System folder	**SL0-TestScreen** Open an animated test pattern screen and save system information in the EUCScore\Results folder. The system information can be used to document the system under test.
	**Primary** Light user type SL1-Base folder	**SL1-NotepadEdit** Open Notepad2 and start writing a novel with random type speed. The Notepad2 executable is located in the EUCScore\Data\Bin\Notepad2\ folder.
	**Primary** Light user type SL1-Base folder	**SL1-NotepadMove** Open Notepad2 and move the application window randomly across the screen. The Notepad2 executable is located in the EUCScore\Data\Bin\Notepad2\ folder.
	**Primary** Light user type SL1-Base folder	**SL1-WordpadScroll (deprecated)** Open local DOCX file with PNG images in Microsoft Wordpad and randomly move pages up and down every second. **NOTE**: WordPad will be removed from all editions of Windows starting in Windows 11, version 24H2 and Windows Server 2025.
	**Primary** Light user type SL1-JPEGView folder	**SL1-JPEGViewStatic** Open JEPG image in JEPG View. The executable is located in the EUCScore\Simloads\SL1-JPEGView\Bin\JPEGView64\ folder. **NOTE**: This is the most basic Simload as it includes neither animations nor user interactions.
	**Primary** Medium user type SL1-JPEGView folder	**SL1-JPEGViewAnim** Open animated GIF image in JEPG View. The executable is located in the EUCScore\Simloads\SL1-JPEGView\Bin\JPEGView64\ folder.

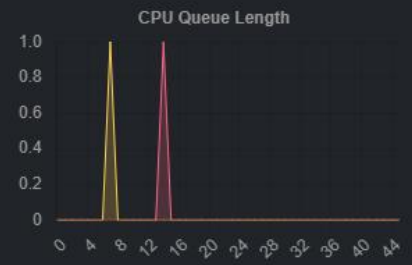
SL1-BSPBlendingDX11 on Physical Machine NUC15Pro w/ Arc GPU | Local Console

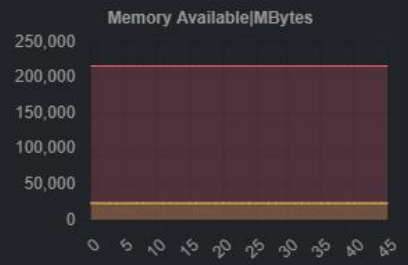


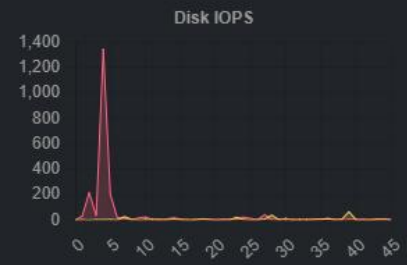
SL1-BSPBlendingDX11 on Azure Windows 365 Enterprise GPU Super | SxS RDP UDP (10ms RTT)

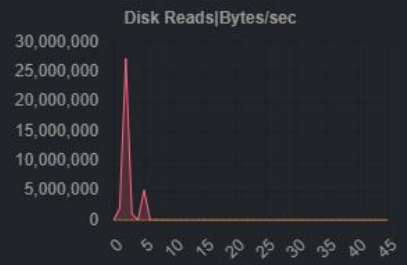


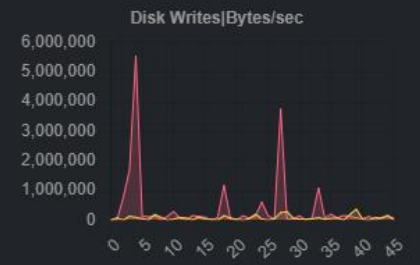


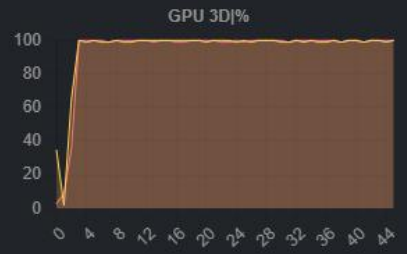


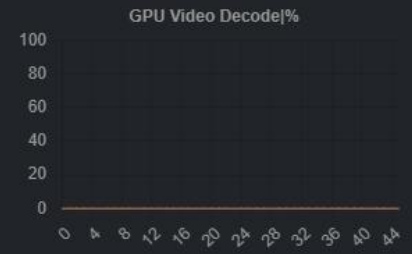


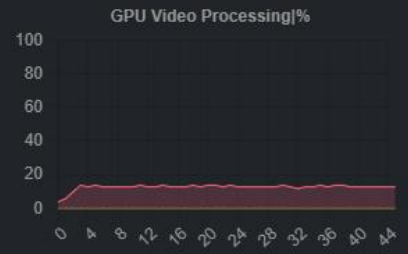


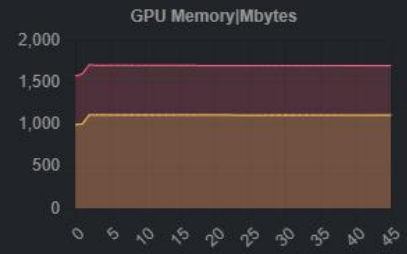


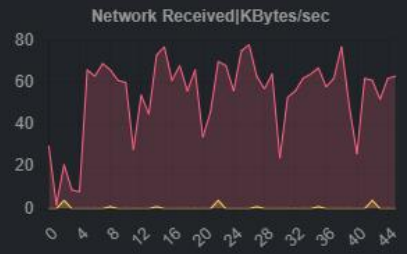


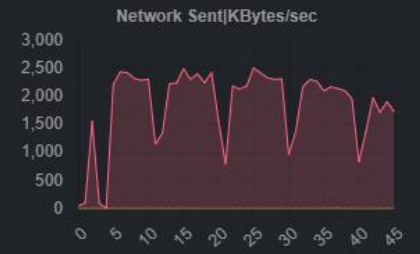






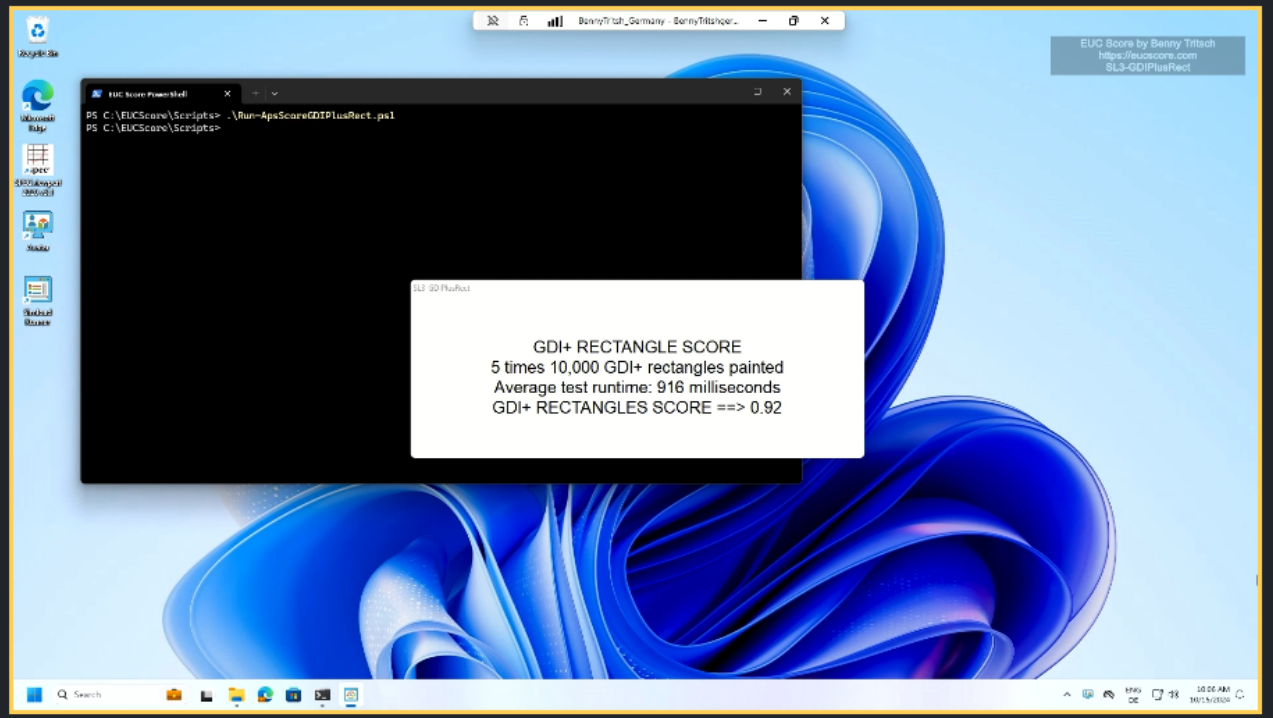






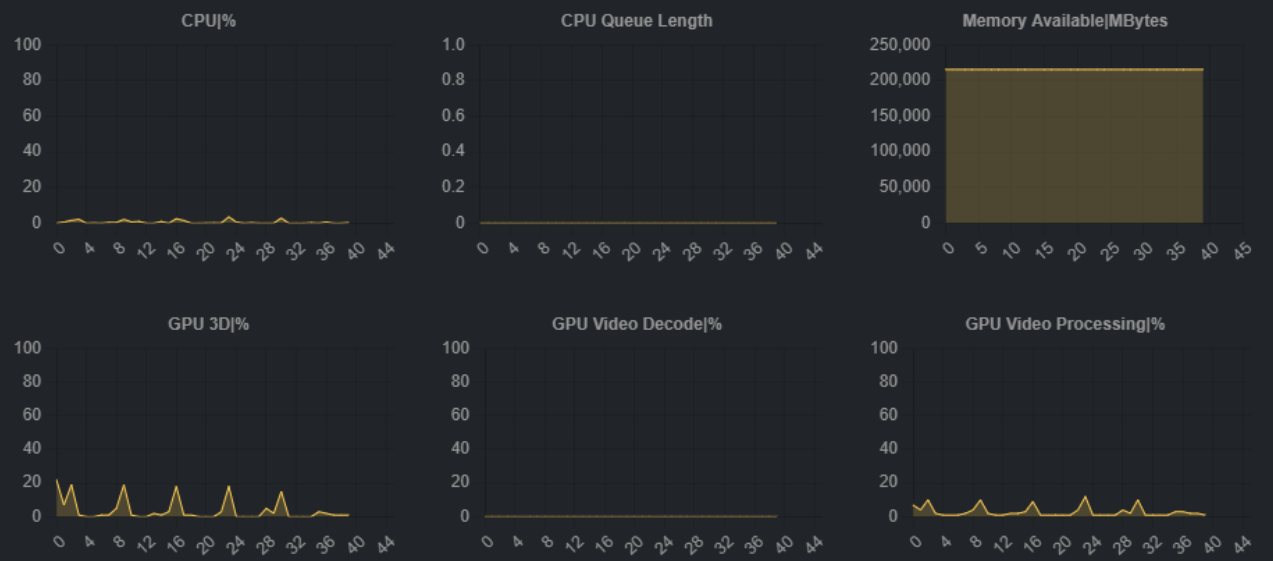
00:00:45 00:00:45 Help Report

SL3-GDIPlusRect on Azure Windows 365 Enterprise GPU Super | SxS RDP UDP (110ms RTT)



SL3-GDIPlusRect on Azure Windows 365 Enterprise GPU Super | SxS RDP UDP (110ms RTT)

```
00:00:00.000  Date: 2024/10/15 | Time: 10:05:39.601 | AppName:
00:00:00.000  Simload: SL3-GDIPlusRect | Computername: CPC-Benny-HOV0M | 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: 1.091 sec
00:00:01.108  SL3-GDIPlusRect: Primary temporary data object created in the registry
00:00:01.111  Run action initiated
00:00:01.116  Paint area for rectangles is 0 0 1920 1080
00:00:01.120  Run #1: Start painting 10000 GDI+ rectangles
00:00:02.067  Run #1: Time to paint 10000 GDI+ rectangles is 943 milliseconds
00:00:08.091  Run #2: Start painting 10000 GDI+ rectangles
00:00:08.994  Run #2: Time to paint 10000 GDI+ rectangles is 901 milliseconds
00:00:15.016  Run #3: Start painting 10000 GDI+ rectangles
00:00:15.914  Run #3: Time to paint 10000 GDI+ rectangles is 896 milliseconds
00:00:21.931  Run #4: Start painting 10000 GDI+ rectangles
00:00:22.831  Run #4: Time to paint 10000 GDI+ rectangles is 899 milliseconds
00:00:28.854  Run #5: Start painting 10000 GDI+ rectangles
00:00:29.797  Run #5: Time to paint 10000 GDI+ rectangles is 941 milliseconds
00:00:35.818  Average time to paint 10000 GDI+ rectangles is 916 milliseconds
00:00:35.819  GDI+ RECTANGLES SCORE ==> 0.92
```



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

Score Simload Results

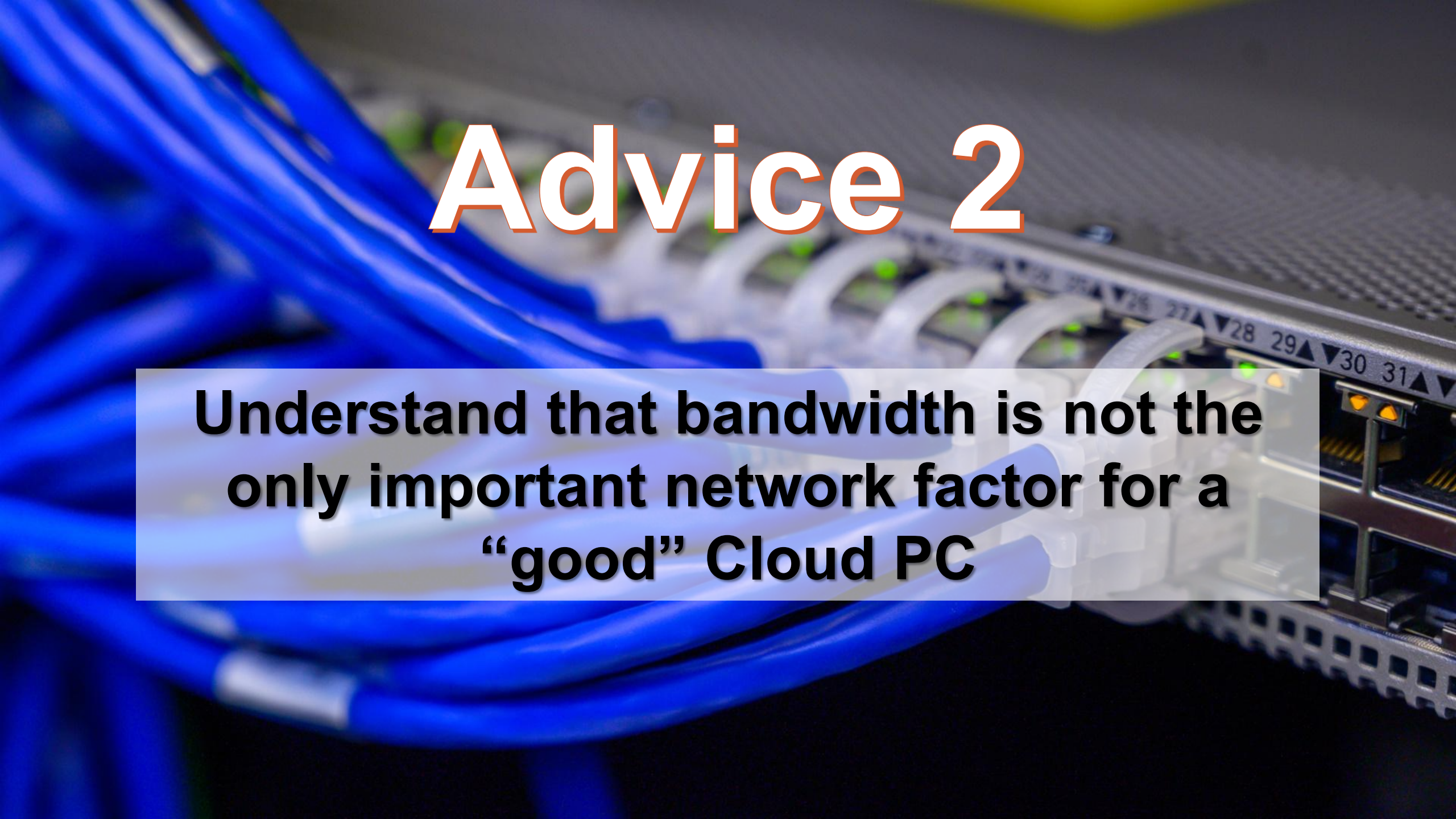
		C	D	E	F	G	H		J	K	L		M
Test Sequence	**Date**	**App Dialog**	**App Start**	**GDI Rectangles**	**IOPS**	**User Profile Large**	**User Profile Small**		**Apps**	**GDI**	**Storage**		**Overall**
		◀better	◀better	◀better	◀better	◀better	◀better		better▶	better▶	better▶		better▶
Lancelot 8 Intel CPU Cores / 16 Threads RTX 4060 GPU Physical	2025-06	0.28	0.74	0.73	1.97	4.68	1.50		4.92	6.85	3.79		5.19
NUC15Pro 16 Intel Cores Arc 140T GPU Physical	2025-06	0.30	0.63	0.56	0.79	2.51	1.11		4.92	8.93	7.66		7.17
CPC 4 AMD vCPUs RDP	2025-06	0.30	0.63	1.21	9.39	8.66	2.67		4.92	4.13	1.41		3.49
CPC 8 Intel vCPUs RDP	2025-06	0.30	0.60	1.23	6.23	7.46	2.52		5.00	4.07	1.70		3.59
Win365GPUSuper-High 18 AMD vCPUs A10-12Q GPU RDP	2024-10	0.28	0.61	0.90	6.35	7.24	2.25		5.21	5.56	1.80		4.19
Win365GPUSuper-Medium 18 AMD vCPUs A10-12Q GPU RDP	2024-10	0.28	0.60	0.88					5.24	5.68	1.80		4.24
Win365GPUStd 12 AMD vCPUs A10-8Q GPU RDP	2024-09	0.29	0.64	0.91	5.82	8.99	2.13		5.01	5.49	1.85		4.12
Win365GPUStd NoAVC444 12 AMD vCPUs A10-8Q GPU RDP	2024-08	0.28	0.60	0.89	4.84	8.93	2.21		5.24	5.62	1.96		4.27
Azure NC4as_T4_v3 4 AMD vGPUs T4 GPU PCoIP	2024-08	0.29	0.89	1.60	23.80	15.29	3.54		4.57	3.13	0.86		2.85
AVD D2asv5 2 AMD vGPUs RDP	2024-07	0.31	0.62	1.58	8.69	6.99	2.73		4.84	3.16	1.48		3.16
Windows 365 Enterprise 2 vCPUs RDP	2023-10	0.36	0.78	2.04	13.83				4.06	2.45	1.45		2.65
Lancelot 8 Intel CPU Cores / 16 Threads NoGPU RDP	2023-09	0.30	0.61	0.88	2.43				4.97	5.68	8.23		6.29
Lancelot 8 Intel CPU Cores / 16 Threads M5000 GPU RDP	2023-09	0.30	0.61	0.73	2.93				4.97	6.85	6.83		6.22
AVD D8adsv5 8 AMD vCPUs RDP	2023-09	0.31	0.57	1.10	9.03				4.98	4.55	2.21		3.91
AVD NC8asT4v3 8 AMD vCPUs T4 GPU RDP	2023-09	0.28	0.62	1.26	10.72				5.18	3.97	1.87		3.67
AVD NV6adsA10v5 6 AMD vCPUs A10-4Q GPU RDP	2023-09	0.28	0.58	0.83	12.32				5.30	6.02	1.62		4.31
Windows 365 Business 2 AMD vCPUs RDP	2023-09	0.33	0.69	1.98	14.67				4.48	2.53	1.36		2.79
NUC2 4 Intel CPU Cores / 8 Threads Radeon RX Vega GPU Physical	2023-01	0.30	0.74	1.27	2.84				4.68	3.94	7.04		5.22
Reference		0.15	0.30	0.50	0.55	2.50	1.00		10.00	10.00	10.07		10.02

J = (1/C) + (1/D)

K = 1/E * 5

L = (1/F*4)+(1/G*2)+(1/H*2)

M = (J+K+L)/3

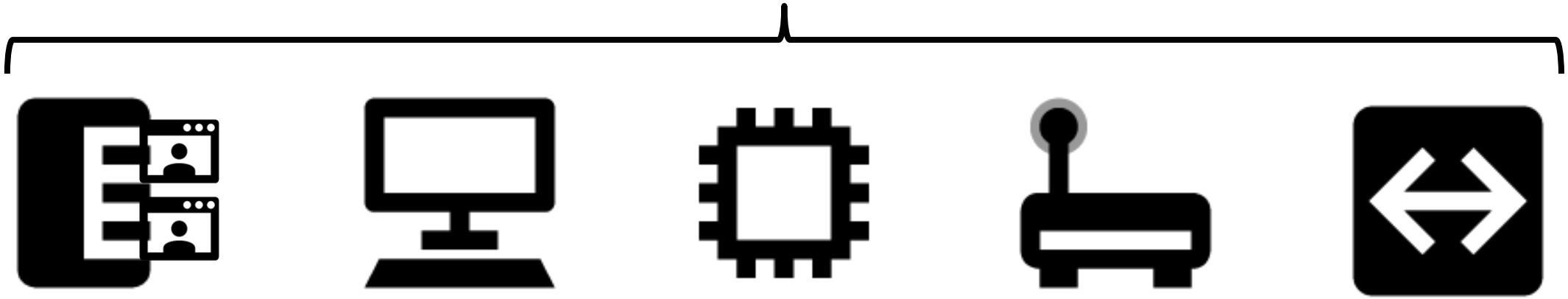


Advice 2

Understand that bandwidth is not the only important network factor for a “good” Cloud PC

Cloud Windows User Experience Influencers

Let’s focus on the network parameters and the remoting protocol



Host System “VM Type”

Client Device “Endpoint”

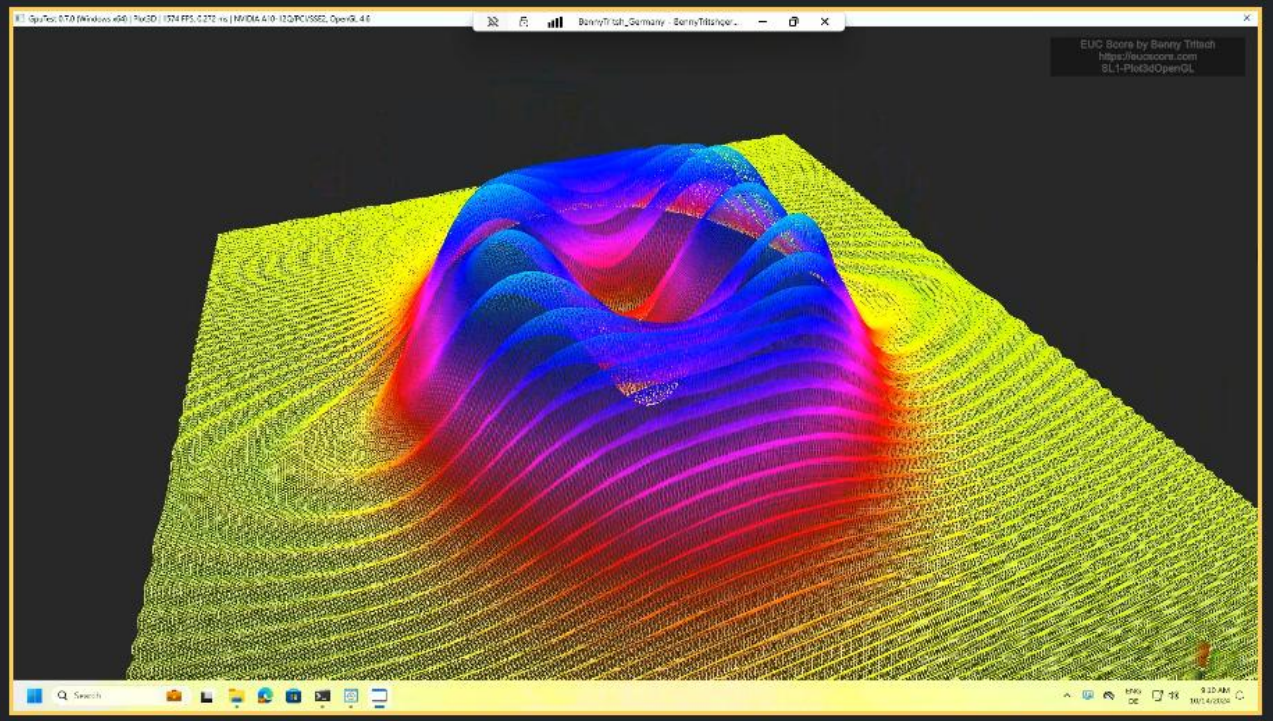
GPUs

Network

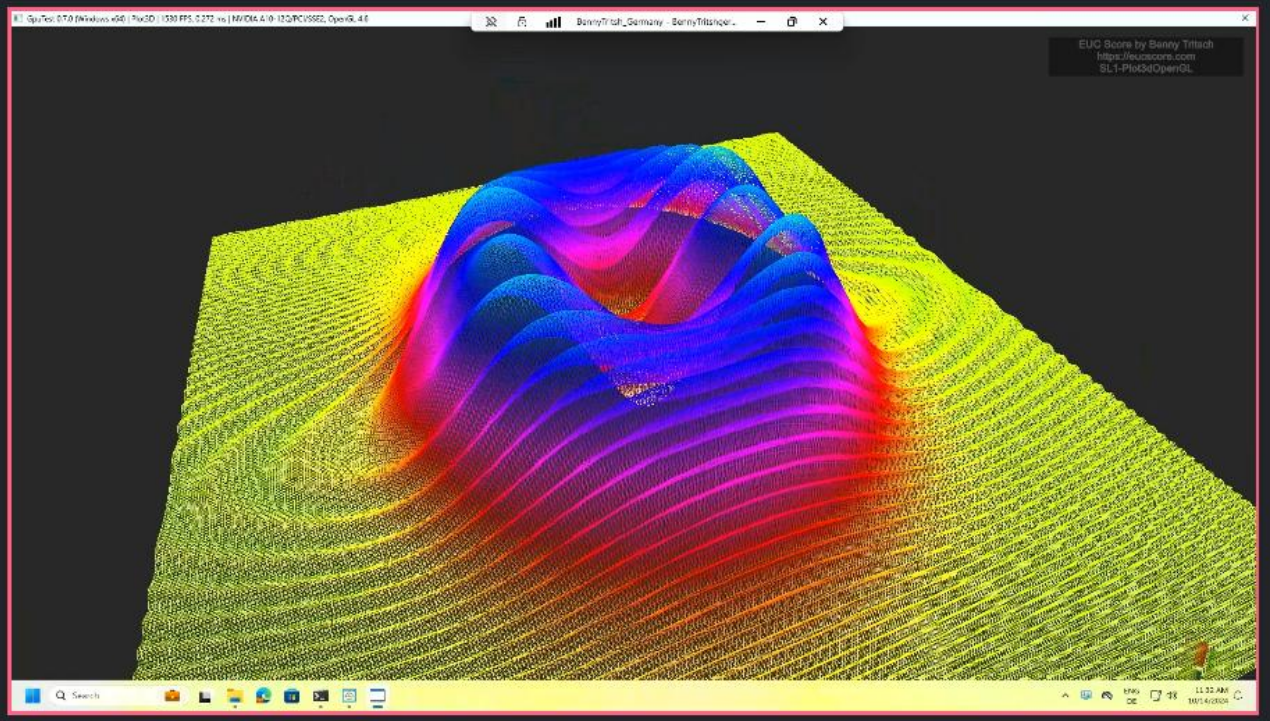
- Bandwidth
- Latency
- Packet Loss

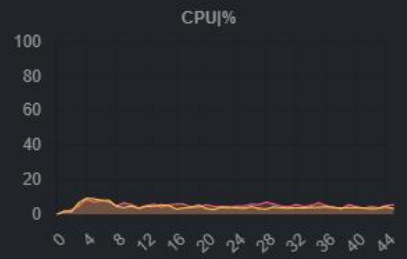
Remoting Protocol

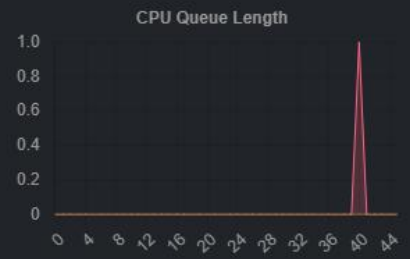
SL1-Plot3dOpenGL on Azure Windows 365 Enterprise GPU Super | SxS RDP UDP (10ms RTT)

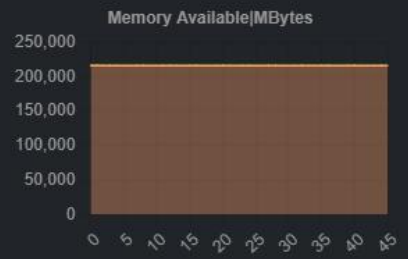


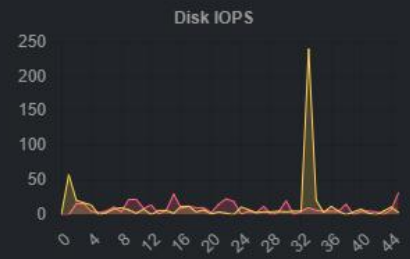
SL1-Plot3dOpenGL on Azure Windows 365 Enterprise GPU Super | SxS RDP UDP (10ms RTT, 2% packet loss)

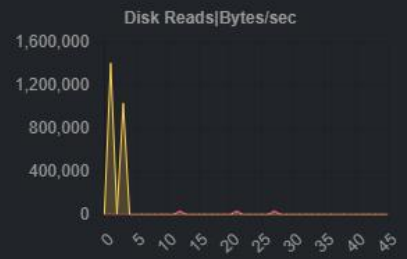


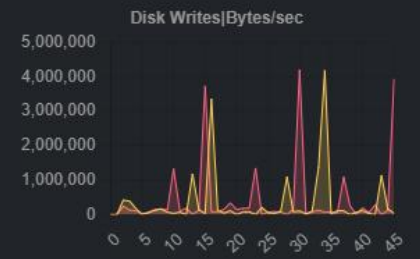


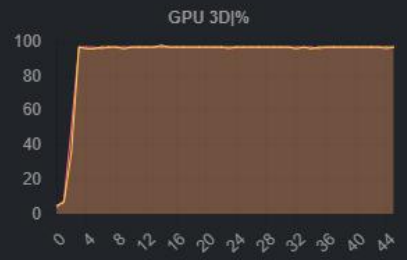


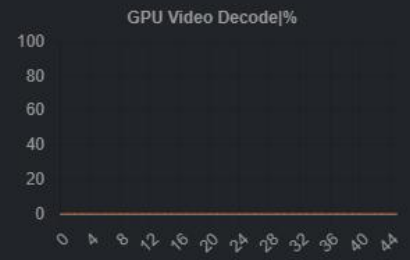


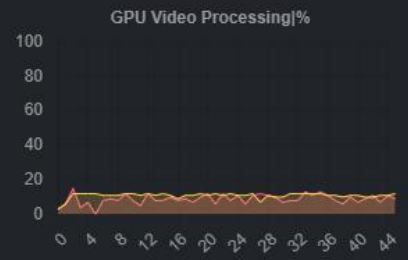


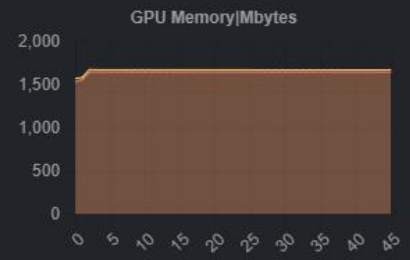


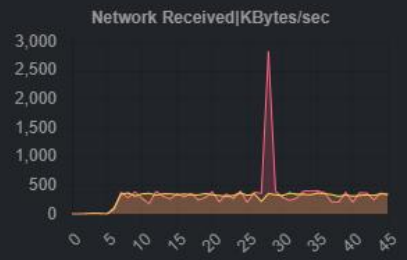


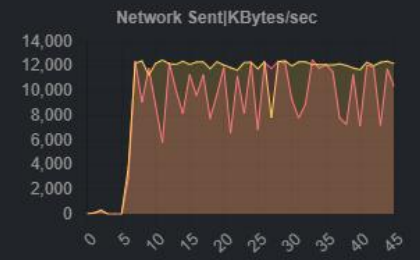




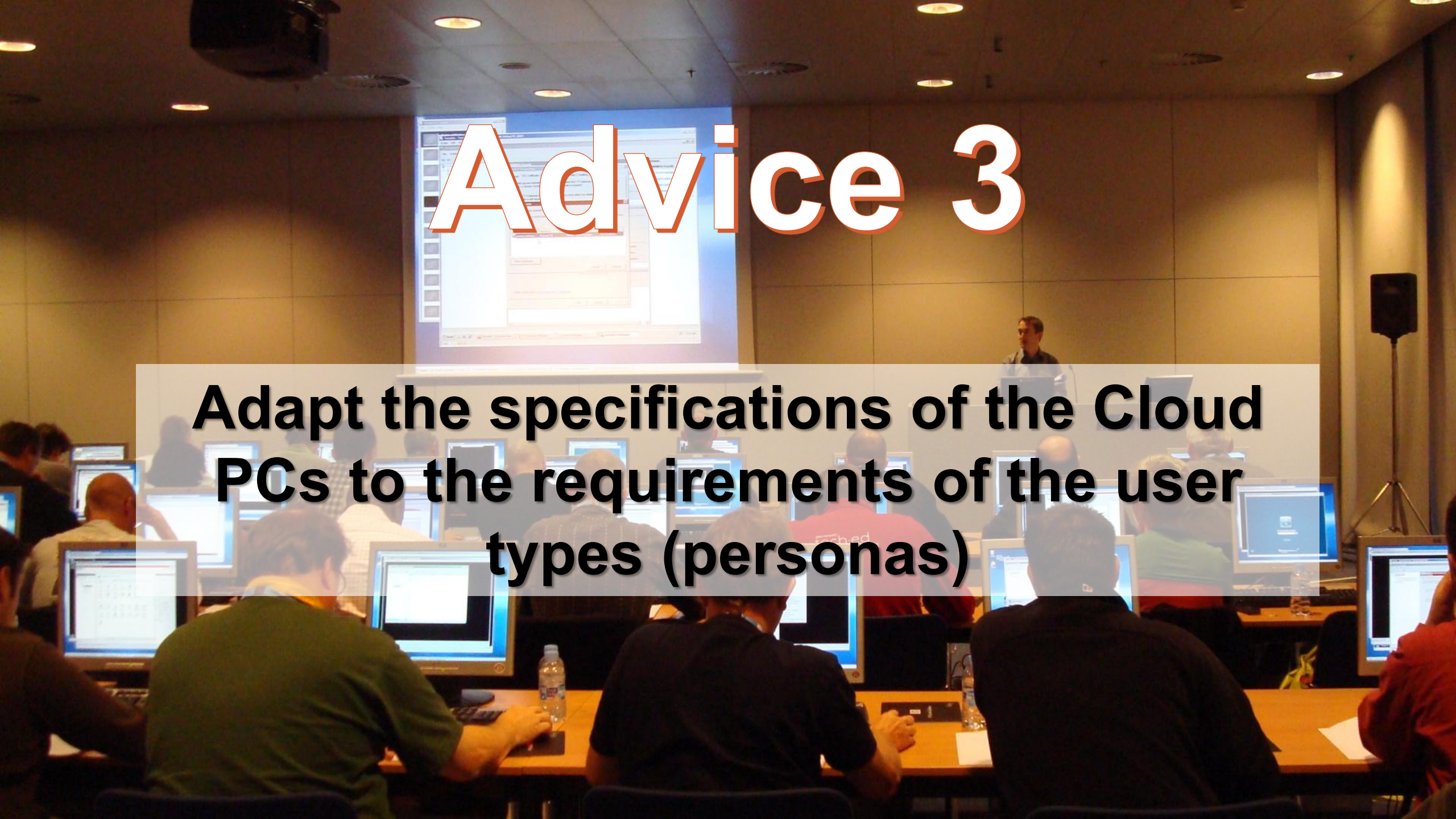








00:00:44 00:00:44 Help Report



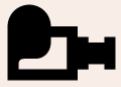
Advice 3

Adapt the specifications of the Cloud PCs to the requirements of the user types (personas)

Individual requirements

- Logon time / reconnection time
- User input delay (“lag”)
- Screen refresh rate and graphic quality
- App start time and app compatibility

Personas, Requirements & VM Types

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

Three Ways to User Happiness (or not)

- Optimize your Cloud PCs so that all relevant application types behave the same as on physical machines (if possible)
- Understand that bandwidth is not the only important network factor for a “good” Cloud PC
- Adapt the specifications of the Cloud PCs to the requirements of the user types (personas)

From Darkness to Brightness

- Don’t walk in the dark: Test labs and POCs are your friends
  - **Check VM specs** and select adequate VM types (performance vs. price)
  - **Analyze network constraints** and consider VM location change
  - **Identify personas** based on app and user requirements
- Ask simple and clearly defined questions that can be answered by experiments (the “MythBusters” principle)
- Both quantitative data (= scores) and qualitative data (= shades) 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

EUC Score

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

https://eucscore.com

Home Page

https://eucscore.com/freeware

Freeware Download

- Blog articles: https://drtritsch.com
- Toolset documentation: https://docs.eucscore.com
- Test Methodology: https://eucscore.com/methodology.html
- 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