

TEAMRGE EVENT 2024 WHERE FUTURE OF END USER COMPUTING MEETS REALITY

10+ community sessions around GPUs, VDI,
DaaS, DEX, Remoting Protocols and AI



15th February 2024

16:00 CEST / 10:00AM EDT / 07:00AM PDT

Register Now

www.teamrge.com/events

This FREE community event is made possible with support of:

DIZZION

itq

EUC Score



Dr. Benny Tritsch
Managing Director at
Dr. Tritsch IT Consulting



Bram Wolfs
Consultant at
Wolfs IT Solutions



Eitjo van Gulik
Principal Product Manager
for HDX Graphics & Seamless
at Citrix



Esther Barthel
Solutions Architect
at Cognition IT



Joe DaSilva
PMTS, Solutions Architect, Cloud
Graphics at AMD



Johan van Amersfoort
Technologist EUC & AI
at ITQ



Magnar Johnson
Manager | Solution Architect
Sopra Steria



Rody Kossen
Senior Principal Quality
Engineer at Citrix



Ruben Spruijt
Field CTO
at Dizzion



Ryan Ververs-Bijkerk
Technical Evangelist
at GO-INIT



Shawn Bass
Start-up advisor and
former EUC CTO of Desktop
Technologies at VMware



Thomas Poppelgaard
Independent Consultant and
Technology Evangelist at
Poppelgaard.com



TeamRGE
Remoting Graphics Experts

RUBEN'S DEEP DAAS ANALYSIS IN AZURE, AWS, AND GCP - UNDERSTANDING PERFORMANCE AND PRICE – 2024 EDITION



Ruben Spruijt
Field CTO at Dizzion

This FREE community event is made possible with support of:



AGENDA

1. System Performance / User Experience
2. Overview of Applications and Tools used
3. Performance and Costs “CloudPC” w/o GPU
4. Performance and Costs “Cloud Workstation” w/ GPU and various GPU applications
5. Performance and Costs “Cloud Workstation” w/ GPU and various AEC applications
6. “40 studies”

A complex network diagram with numerous white nodes and blue connecting lines, set against a dark blue background. The network is dense and interconnected, with lines of varying thicknesses and colors (light blue to dark blue).

System Performance

User Experience



Upgrade



AVG 102.8 104.4 MAX 111.4



The image features a close-up of a perforated metal mesh. The mesh is illuminated from behind, creating a vibrant, multi-colored glow. The colors transition from green on the left, through blue and purple in the center, to red and orange on the right. A solid purple horizontal band is superimposed over the center of the mesh. The word "WHY" is written in white, bold, uppercase letters across this purple band.

WHY



- How do the performance and cost-effectiveness of DaaS instances on AWS, Azure, and GCP compare?
- Analyzing User Experience: A Comparison between Physical Workstations, On-Premises Remote Desktops, and Cloud-Based Desktops!

A complex network diagram with numerous white nodes and blue connecting lines, set against a dark blue background. The network is dense and interconnected, with lines radiating from several central nodes.

System Performance

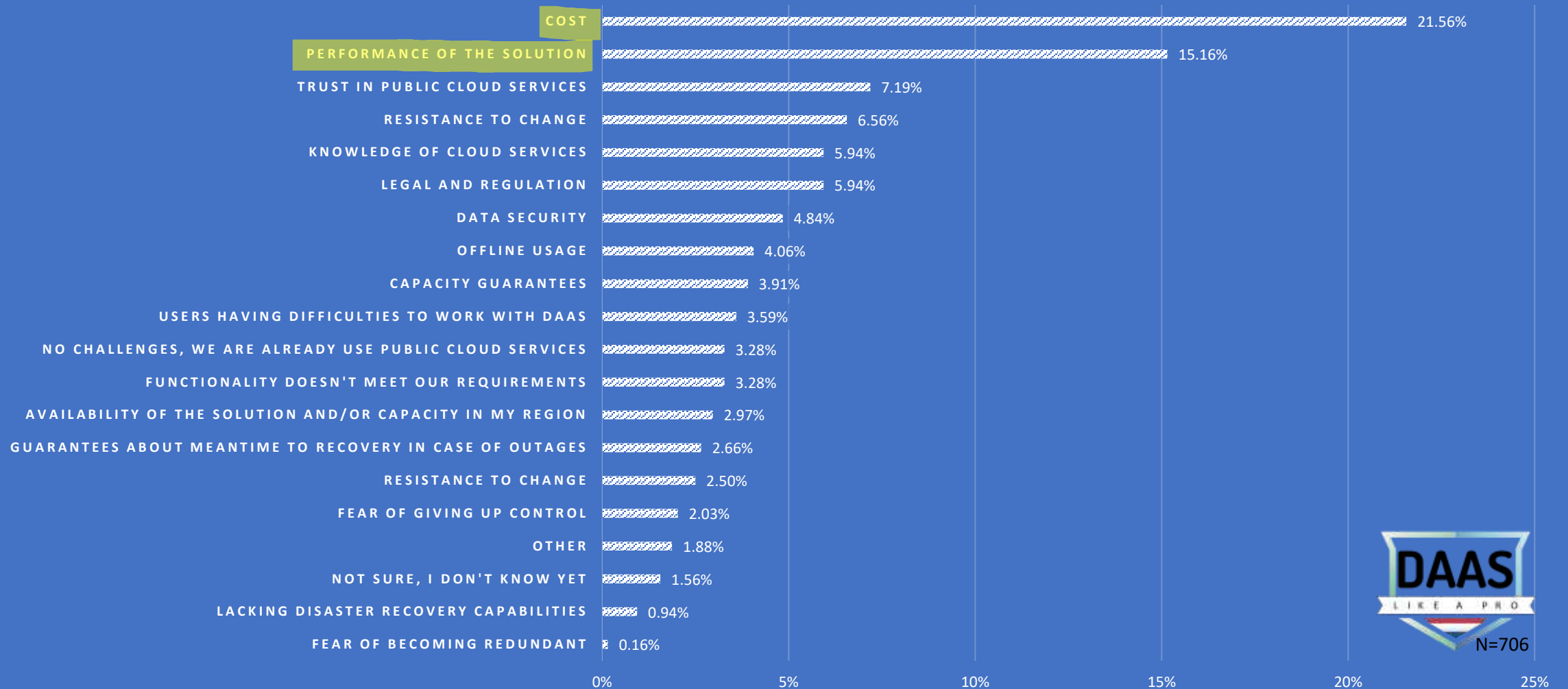
User Experience



DAAAS

LIKE A PRO

WHAT ARE THE BIGGEST CHALLENGES IN YOUR ORGANIZATION CAUSED BY USING OR ADOPTING DAAS?



N=706

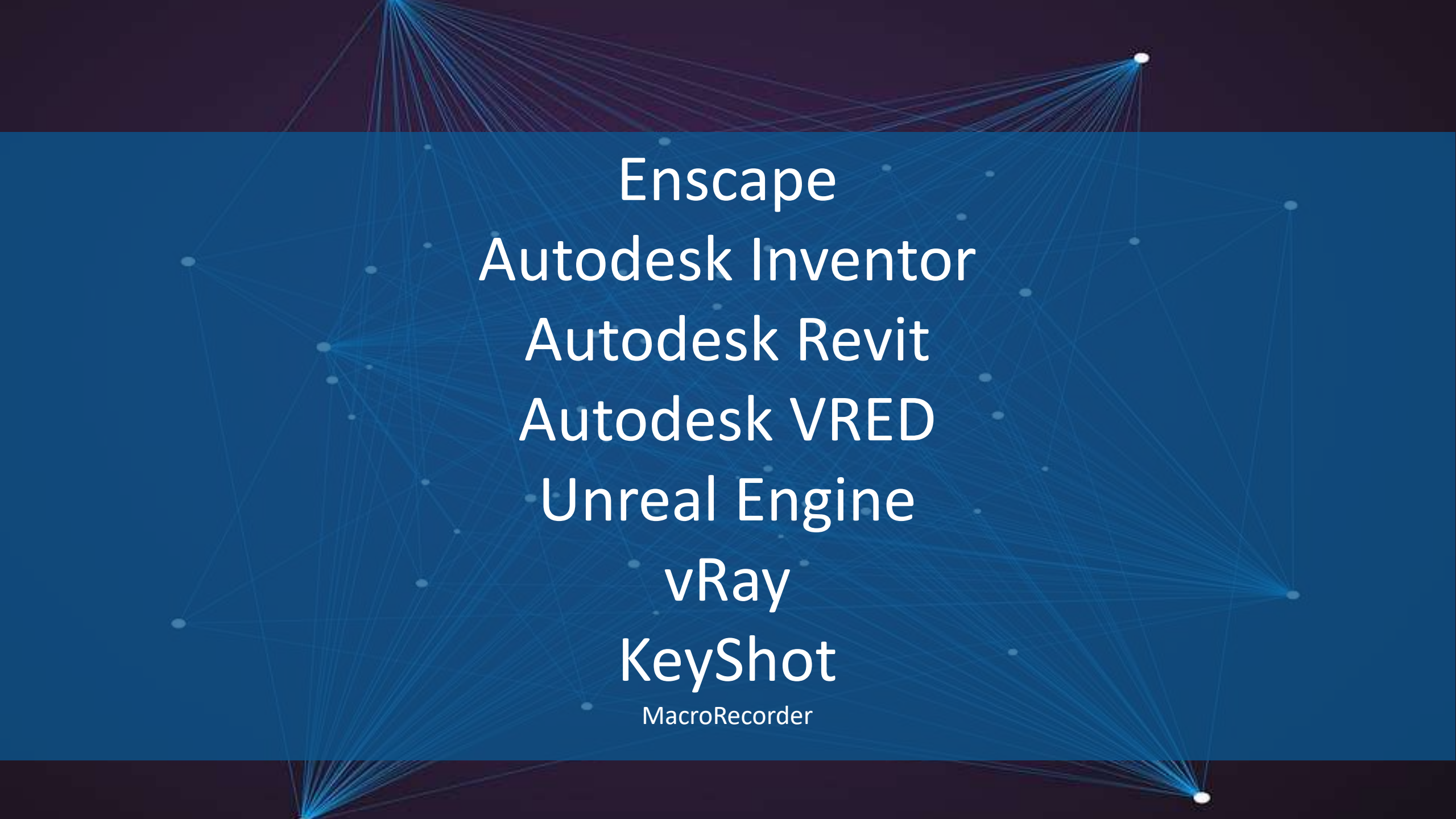
A complex network diagram with numerous white nodes connected by thin blue lines, set against a dark blue background. The nodes are distributed across the frame, with a higher density of connections in the upper and lower right areas.

System Performance

Applications/Tools Used



CPU-Z
CineBench
Crystal Disk Mark
Blender Benchmark CPU/GPU
EUC Score
IOMeter
EUX Score – Login Enterprise
SPEC 2020



Enscape
Autodesk Inventor
Autodesk Revit
Autodesk VRED
Unreal Engine
vRay
KeyShot

MacroRecorder



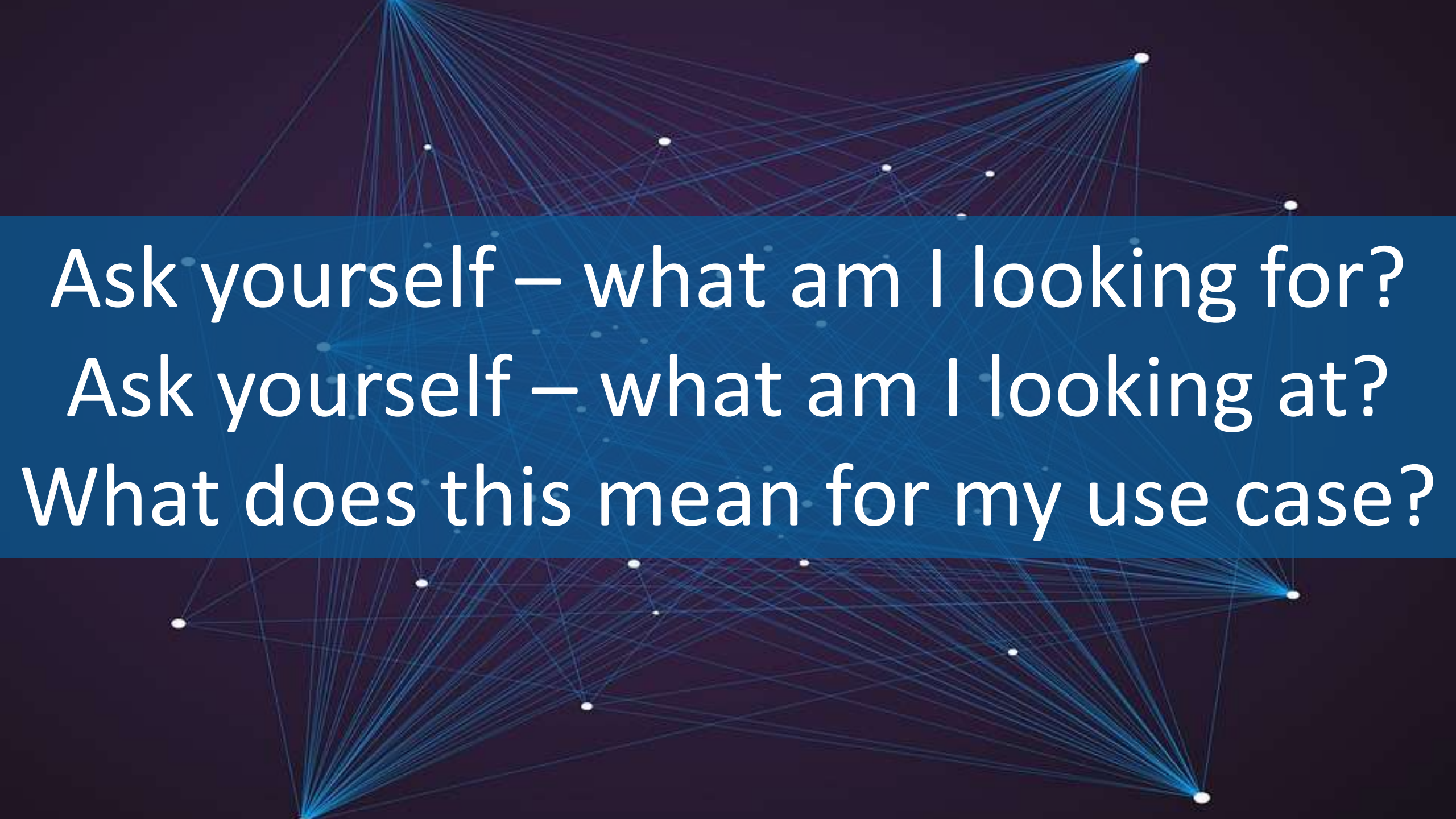
Google Cloud Platform

DIZZI  **N**

 **FRAME**



Observations & Lessons Learned



Ask yourself – what am I looking for?
Ask yourself – what am I looking at?
What does this mean for my use case?




Cloud PC without GPU

CPU-Z

CPU | Mainboard | Memory | SPD | Graphics | Bench | About

Processor

Name: AMD EPYC
 Code Name: Genoa Brand ID:
 Package: Socket SP5 (6096)
 Technology: 7 nm Core VID: 1.550 V



Specification: AMD EPYC 74F3 24-Core Processor

Family	F	Model	1	Stepping	1
Ext. Family	19	Ext. Model	1	Revision	GN-B1

Instructions: MMX(+), SSE, SSE2, SSE3, SSSE3, SSE4.1, SSE4.2, SSE4A, x86-64, AES, AVX, AVX2, FMA3, SHA

Clocks (Core #0)		Cache	
Core Speed	3193.00 MHz	L1 Data	18 x 32 KBytes 8-way
Multiplier	x 16.02	L1 Inst.	18 x 32 KBytes 8-way
Bus Speed	199.27 MHz	Level 2	18 x 512 KBytes 8-way
Rated FSB		Level 3	32 MBytes 16-way

Selection: Socket #1 Cores: 18 Threads: 36

CPU-Z Ver. 2.04.0.x64 Tools Validate Close

CPU-Z

CPU | Mainboard | Memory | SPD | Graphics | Bench | About

CPU Single Thread

This Processor: 548.8
 Reference

CPU Multi Thread

This Processor: 12821.0
 Reference

Threads: 36 Multi Thread Ratio: 23.36

Benchmark: Version 17.01.64

Bench CPU Stress CPU Submit and Compare

This Processor: AMD EPYC 74F3 24-Core Processor
 Reference: <Please Select>

CPU-Z Ver. 2.04.0.x64 Tools Validate Close

CPU-Z

CPU (Multi Core)	26897 pts	Start
CPU (Single Core)	1310 pts	Start
MP Ratio	20.54 x	

Your System

Processor	AMD EPYC 74F3 24-Core Processor
Cores x GHz	18 Cores, 36 Threads @ 3.2 GHz
OS	Windows 10, 64 Bit, Professional Edition (build 19045)
Info	

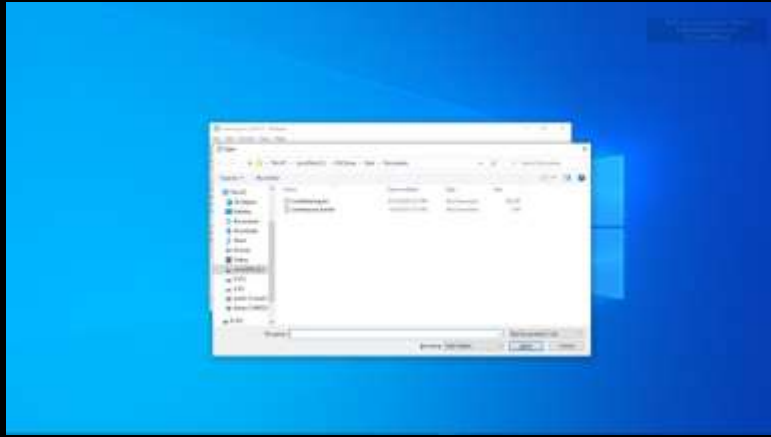
Ranking

CPU (Single Core) ▾	Details ▾
1. 4C/8T @ 2.81 GHz, 11th Gen Intel Core i7-1165G7 @ 28W	1532
2. 4C/8T @ 1.69 GHz, 11th Gen Intel Core i7-1165G7 @ 15W	1382
3. 18C/36T @ 3.2 GHz, AMD EPYC 74F3 24-Core Processor	1310
4. 6C/12T @ 3.2 GHz, AMD EPYC 74F3 24-Core Processor	1309
5. 3C/6T @ 3.2 GHz, AMD EPYC 74F3 24-Core Processor	1295

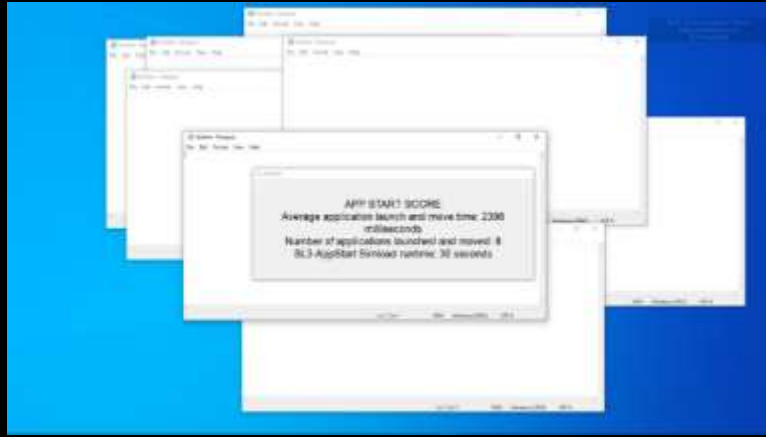
CineBench R23

```
EuxRunner.exe - Shortcut
RUN LocalAppdata: C:\Tools\EUX2023\DiskSpeed.exe folder="C:\Users\Fram\AppData\Local\eux2023" blockSize=50k bufferSize=4K writeMask=0x0C0C cachePct=95 latencyPct=95 threads=1 duration=1000
New measurement: diskappdata_latency = 55555
New measurement: diskappdata = 54535
RUN CPU: C:\Tools\EUX2023\CpuSpeed.exe d=1000 t=2
New measurement: cpuspeed = 100864
RUN Compression: C:\Tools\EUX2023\CompressionSpeed.exe folder="C:\Users\Fram\Documents\eux2023" cachePct=25 writePct=35 duration=1000 threads=1 -high
New measurement: highcompression = 1763
RUN CachedHighCompression: C:\Tools\EUX2023\CompressionSpeed.exe folder="C:\Users\Fram\Documents\eux2023" cachePct=25 writePct=35 duration=1000 threads=1
New measurement: fastcompression = 2064
RUN App: C:\Tools\EUX2023\AppSpeed.exe folder="C:\Users\Fram\Documents\eux2023" duration=10000 launchtimestamp=27468157833
New measurement: appspeed_userinput = 904
New measurement: appspeed = 9523
diskmydocs_latency score: 9.30, result = 3636.36 (20000.00)
diskmydocs score: 9.16, result = 2909.84 (24733.67)
diskappdata_latency score: 9.78, result = 7671.90 (53703.33)
diskappdata score: 9.30, result = 3669.40 (51371.67)
cpuspeed score: 8.76, result = 2018.81 (100940.67)
highcompression score: 7.13, result = 875.73 (2189.33)
fastcompression score: 6.69, result = 730.67 (1826.67)
appspeed_userinput score: 8.51, result = 1809.33 (904.67)
appspeed score: 9.30, result = 3696.00 (9240.00)
Weight 1 of highcompression is converted to 1.15 because of score 7.13 (correction = 1.15)
Weight 1 of fastcompression is converted to 1.34 because of score 6.69 (correction = 1.34)
EUX2022 = 8.40
Press any key to close this window
```

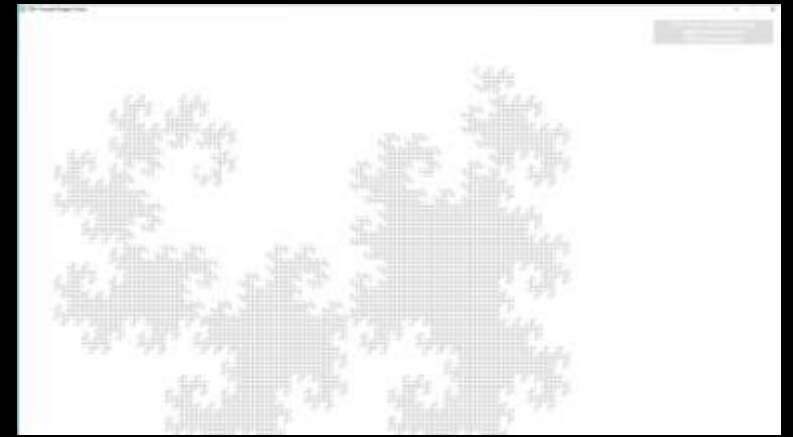
Login Enterprise - EUX Score



SL3-AppDialog



SL3-AppStart



SL3-FractalsDragon



SL3-FractalsPythagorasTree



SL3-GDIPlusRect



SL3-IOPS

EUC Score – Score Simloads

CPU INSTANCE PERFORMANCE & COSTS

Instance	CPU	CPU Base Clock Speed	Max CPU Speed - single-core	vCPUs	RAM	Storage Type	Storage Size	GPU	GPU RAM	Display	OS	CPUZ -	CPUZ -	CBR23 -	CBR23 -	EUX	EUC Score	EUC Score	EUC Score	EUC Score	EUC Score	EUC Score	Price	CPU-Perf /Price	EUC-Score-CPU /Price	EUX Score /Price	CPU-Perf /Price	EUC-Score-CPU /Price	EUX Score /Price
												ST	MT	MC	SC	2023	AppDialog	App Start	GDI+ Dragon	Tree	Rectangles	IOPS							
Microsoft Azure																													
Azure D2s_v3	Intel Xeon 8272 - Cascade Lake	2.6 GHz	3.7 GHz	2	8 GiB	Premium-SSD	256GB	N/A	N/A	FHD	Win10 22H2	241.1	427.2	489	N/A	7.37	0.54	0.72	5.68	9.52	6.44	7.82	0.21	1837	36.19	35.10	50.17	60.64	61.88
Azure D4s_v3	Intel Xeon 8272 - Cascade Lake	2.6 GHz	3.7 GHz	4	16 GiB	Premium-SSD	256GB	N/A	N/A	FHD	Win10 22H2	250.7	817.2	1308	659	7.85	0.31	0.69	3.27	5.57	3.28	6.4	0.42	1886	10.52	18.69	51.49	17.63	32.96
Azure D2s_v5	Intel Xeon 8370C - IceLake	2.8 GHz	3.5 GHz	2	8 GiB	Premium-SSD	256GB	N/A	N/A	FHD	Win10 22H2	323.4	545.4	1284	N/A	8.23	0.35	0.63	3.12	5.51	3.58	7.62	0.20	3588	21.58	41.15	07.98	36.15	72.56
Azure D2s_v5	Intel Xeon 8370C - IceLake	2.8 GHz	3.5 GHz	2	8 GiB	Standard-SSD	256GB	N/A	N/A	FHD	Win10 22H2	308.9	570	1216	N/A	7.38	0.33	0.67	3.36	5.06	3.28	10.96	0.20	3492	21.05	36.90	95.35	35.27	65.06
Azure D4s_v5	Intel Xeon 8370C - IceLake	2.8 GHz	3.5 GHz	4	16 GiB	Premium-SSD	256GB	N/A	N/A	FHD	Win10 22H2	430	1101	2724	1055	8.03	0.3	0.61	1.83	3.31	1.36	6.64	0.41	3443	6.27	19.50	94.03	10.50	34.53
Azure D4s_v5	Intel Xeon 8370C - IceLake	2.8 GHz	3.5 GHz	4	16 GiB	Standard-SSD	256GB	N/A	N/A	FHD	Win10 22H2	390	1092	2521	960	6.87	0.29	0.59	2.02	3.33	1.55	9.03	0.41	3254	6.52	16.76	88.88	10.93	29.54
AWS																													
AWS t3.medium	Intel Xeon 8259 - Cascade Lake	2.5 GHz	3.5 GHz	2	4 GiB	EBS GP3	256GB	N/A	N/A	FHD	Server 2019	208.2	396.6	773	N/A	7.94	0.36	0.65	5.48	8.72	6.41	9.47	0.14	3280	50.71	56.71	89.59	84.97	100.00
AWS t3.large	Intel Xeon 8259 - Cascade Lake	2.5 GHz	3.5 GHz	2	8 GiB	EBS GP3	256GB	N/A	N/A	FHD	Server 2019	222.8	425.8	594	N/A	7.92	0.34	0.62	5.18	8.77	7.12	8.48	0.20	2071	34.88	39.60	56.56	58.44	69.82
AWS t3.xlarge	Intel Xeon 8259 - Cascade Lake	2.5 GHz	3.5 GHz	4	16 GiB	EBS GP3	256GB	N/A	N/A	FHD	Server 2019	260	774	1604	570	7.86	0.33	0.66	5.33	9.79	5.88	8.7	0.33	2665	22.91	23.82	72.77	38.39	42.00
AWS m6i.large	Intel Xeon 8375C - IceLake	2.9 GHz	3.5 GHz	2	8 GiB	EBS GP3	256GB	N/A	N/A	FHD	Server 2019	286	520	981	N/A	8.49	0.28	0.59	3.33	5.37	4.98	8.53	0.20	2978	21.75	42.45	81.33	36.44	74.85
AWS m6i.xlarge	Intel Xeon 8375C - IceLake	2.9 GHz	3.5 GHz	4	16 GiB	EBS GP3	256GB	N/A	N/A	FHD	Server 2019	385	1081	1574	612	8.11	0.3	0.6	3.9	6.71	4.59	5.41	0.40	2533	13.26	20.28	69.18	22.22	35.75
AWS m6i.2xlarge	Intel Xeon 8375C - IceLake	2.9 GHz	3.5 GHz	8	32 GiB	EBS GP3	256GB	N/A	N/A	FHD	Server 2019	406.7	2209	5406	1076	8.61	0.29	0.55	1.89	3.04	0.97	8.2	0.80	3342	2.96	10.76	91.27	4.95	18.98
GCP																													
GCP N1-Standard-2-Win	Intel Xeon - Skylake	2.0 GHz	3.5 GHz	2	7.5 GiB	Zonal SSD PD	256GB	N/A	N/A	FHD	Server 2019	167.3	328.5	544	N/A	7.6	0.35	0.62	7.53	12.16	5.08	5.57	0.20	1777	50.49	38.97	48.54	84.59	68.72
GCP N1-Standard-4-Win	Intel Xeon - Skylake	2.0 GHz	3.5 GHz	4	15 GiB	Zonal SSD PD	256GB	N/A	N/A	FHD	Server 2019	213.9	681.6	1545	594	8.09	0.3	0.6	3.93	7.04	4.86	6.08	0.39	2086	34.06	20.74	56.96	23.57	36.58
GCP E2-Standard-2-Win	Intel Xeon - Broadwell	2.2 GHz	3.7 GHz	2	8 GiB	Zonal SSD PD	256GB	N/A	N/A	FHD	Server 2019	188.8	360.6	736	N/A	7.53	0.35	0.62	6.89	11.85	7.56	6.24	0.16	2729	59.68	47.96	74.53	100.00	84.57
GCP E2-Standard-4-Win	Intel Xeon - Broadwell	2.2 GHz	3.7 GHz	4	16 GiB	Zonal SSD PD	256GB	N/A	N/A	FHD	Server 2019	225.2	701	1626	637	8.01	0.3	0.61	4.19	7.09	5.34	6.15	0.32	2634	17.46	24.80	71.93	29.26	43.73
GCP N2d-Standard-2-Win	AMD EPYC - Rome	2.25	3.3 GHz	2	8 GiB	Zonal SSD PD	256GB	N/A	N/A	FHD	Server 2019	275.7	538.7	1163	N/A	8.46	0.29	0.58	3.71	6.60	3.56	4.68	0.18	3662	28.64	47.00	100.00	47.99	82.87
GCP N2d-Standard-4-Win	AMD EPYC - Rome	2.25	3.3 GHz	4	16 GiB	Zonal SSD PD	256GB	N/A	N/A	FHD	Server 2019	343.8	1054	2523	882	8.62	0.29	0.57	2.29	4.12	1.81	4.39	0.36	3631	8.90	23.94	99.15	14.92	42.22
GCP custom-2-4096-Win	Intel Xeon - Skylake	2.0 GHz	3.5 GHz	2	4 GiB	Zonal SSD PD	256GB	N/A	N/A	FHD	Server 2019	170	315	691	N/A	7.5	0.34	0.65	7.87	11.16	8.17	6.63	0.18	2190	53.16	41.90	59.80	89.07	73.88
Physical PC																													
Workstation-RSP	AMD Ryzen 7 5800X	3.8 GHz	4.7 GHz	16	128 GB	NVMe	2TB	NVIDIA RTX A6000	48 GB	FHD	Win11 22H2	647	6461	13674	1463	9.22	0.29	0.63	3.71	6.90	0.71	0.74	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nutanix AHV																													
AIRRGB - OVH	Intel Xeon Gold 622R - Dempsey	2.9 GHz	3.9 GHz	4	8 GB	HGR-HCI-1 (AF)	100GB	N/A	N/A	FHD	Win10 22H2	393.6	1377	3151	815	8.52	0.3	0.65	2.24	3.51	1.8	3.19	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Date: 5/20/2023
 Author: ruben@fra.me
 Version: v5202023
 Notes: Results are indication - not exact science
 results might vary
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notes about pricing:
 Price \$/hour
 On-demand pricing
 Average compute price across all regions
 Windows OS License included
 Storage costs not included



CPU INSTANCE PERFORMANCE & COSTS

Instance	CPU	CPU Base Clock Speed	Max CPU Speed - single-core	vCPUs	RAM	Storage Type	Storage Size	GPU	GPU RAM	Display	OS
Microsoft Azure											
Azure D2s_v3	Intel Xeon 8272 - Cascade Lake	2.6 GHz	3.7 GHz	2	8 GiB	Premium-SSD	256GB	N/A	N/A	FHD	Win10 22H2
Azure D4s_v3	Intel Xeon 8272 - Cascade Lake	2.6 GHz	3.7 GHz	4	16 GiB	Premium-SSD	256GB	N/A	N/A	FHD	Win10 22H2
Azure D2s_v5	Intel Xeon 8370C - IceLake	2.8 GHz	3.5 GHz	2	8 GiB	Premium-SSD	256GB	N/A	N/A	FHD	Win10 22H2
Azure D2s_v5	Intel Xeon 8370C - IceLake	2.8 GHz	3.5 GHz	2	8 GiB	Standard-SSD	256GB	N/A	N/A	FHD	Win10 22H2
Azure D4s_v5	Intel Xeon 8370C - IceLake	2.8 GHz	3.5 GHz	4	16 GiB	Premium-SSD	256GB	N/A	N/A	FHD	Win10 22H2
Azure D4s_v5	Intel Xeon 8370C - IceLake	2.8 GHz	3.5 GHz	4	16 GiB	Standard-SSD	256GB	N/A	N/A	FHD	Win10 22H2
AWS											
AWS t3.medium	Intel Xeon 8259 - Cascade Lake	2.5 GHz	3.5 GHz	2	4 GiB	EBS GP3	256GB	N/A	N/A	FHD	Server 2019
AWS t3.large	Intel Xeon 8259 - Cascade Lake	2.5 GHz	3.5 GHz	2	8 GiB	EBS GP3	256GB	N/A	N/A	FHD	Server 2019
AWS t3.xlarge	Intel Xeon 8259 - Cascade Lake	2.5 GHz	3.5 GHz	4	16 GiB	EBS GP3	256GB	N/A	N/A	FHD	Server 2019
AWS m6i.large	Intel Xeon 8375C - IceLake	2.9 GHz	3.5 GHz	2	8 GiB	EBS GP3	256GB	N/A	N/A	FHD	Server 2019
AWS m6i.xlarge	Intel Xeon 8375C - IceLake	2.9 GHz	3.5 GHz	4	16 GiB	EBS GP3	256GB	N/A	N/A	FHD	Server 2019
AWS m6i.2xlarge	Intel Xeon 8375C - IceLake	2.9 GHz	3.5 GHz	8	32 GiB	EBS GP3	256GB	N/A	N/A	FHD	Server 2019
GCP											
GCP N1-Standard-2-Win	Intel Xeon - Skylake	2.0 GHz	3.5 GHz	2	7.5 GiB	Zonal SSD PD	256GB	N/A	N/A	FHD	Server 2019
GCP N1-Standard-4-Win	Intel Xeon - Skylake	2.0 GHz	3.5 GHz	4	15 GiB	Zonal SSD PD	256GB	N/A	N/A	FHD	Server 2019
GCP E2-Standard-2-Win	Intel Xeon - Broadwell	2.2 GHz	3.7 GHz	2	8 GiB	Zonal SSD PD	256GB	N/A	N/A	FHD	Server 2019
GCP E2-Standard-4-Win	Intel Xeon - Broadwell	2.2 GHz	3.7 GHz	4	16 GiB	Zonal SSD PD	256GB	N/A	N/A	FHD	Server 2019
GCP N2d-Standard-2-Win	AMD EPYC - Rome	2.25	3.3 GHz	2	8 GiB	Zonal SSD PD	256GB	N/A	N/A	FHD	Server 2019
GCP N2d-Standard-4-Win	AMD EPYC - Rome	2.25	3.3 GHz	4	16 GiB	Zonal SSD PD	256GB	N/A	N/A	FHD	Server 2019
GCP custom-2-4096-Win	Intel Xeon - Skylake	2.0 GHz	3.5 GHz	2	4 GiB	Zonal SSD PD	256GB	N/A	N/A	FHD	Server 2019
Physical PC											
Workstation-RSP	AMD Ryzen 7 5800X	3.8 GHz	4.7 GHz	16	128 GB	NVMe	2TB	NVIDIA RTX A6000	48 GB	FHD	Win11 22H2
Nutanix AHV											
AIR8GB - OVH	Intel Xeon Gold 622R - Dempsey	2.9 GHz	3.9 GHz	4	8 GB	HGR-HCI-1 (AF)	100GB	N/A	N/A	FHD	Win10 22H2

CPU INSTANCE PERFORMANCE & COSTS

Instance	CPUZ - ST	CPUZ - MT	CBR23 - MC	CBR23 - SC	EUX 2023	EUC Score AppDialog	EUC Score App Start	EUC Score GDI+ Dragon	EUC Score Tree	EUC Score Rectangles	EUC Score IOPS	Price
Microsoft Azure									ruben@fra.me			
Azure D2s_v3	241.1	427.2	489	N/A	7.37	0.54	0.72	5.68	9.52	6.44	7.82	0.21
Azure D4s_v3	250.7	817.2	1308	659	7.85	0.31	0.69	3.27	5.57	3.28	6.4	0.42
Azure D2s_v5	323.4	545.4	1284	N/A	8.23	0.35	0.63	3.12	5.51	3.58	7.62	0.20
Azure D2s_v5	308.9	570	1216	N/A	7.38	0.33	0.67	3.36	5.06	3.28	10.96	0.20
Azure D4s_v5	410	1101	2724	1055	8.03	0.3	0.61	1.83	3.31	1.36	6.64	0.41
Azure D4s_v5	390	1092	2521	960	6.87	0.29	0.59	2.02	3.33	1.55	9.03	0.41
AWS									ruben@fra.me			
AWS t3.medium	208.2	396.6	773	N/A	7.94	0.36	0.65	5.48	8.72	6.41	9.47	0.14
AWS t3.large	222.8	425.8	594	N/A	7.92	0.34	0.62	5.18	8.77	7.12	8.48	0.20
AWS t3.xlarge	260	774	1604	570	7.86	0.33	0.66	5.33	9.79	5.88	8.7	0.33
AWS m6i.large	286	520	981	N/A	8.49	0.28	0.59	3.33	5.37	4.98	8.53	0.20
AWS m6i.xlarge	385	1081	1574	612	8.11	0.3	0.6	3.9	6.71	4.59	5.41	0.40
AWS m6i.2xlarge	406.7	2209	5406	1076	8.61	0.29	0.55	1.69	3.04	0.97	8.2	0.80
GCP									ruben@fra.me			
GCP N1-Standard-2-Win	167.3	328.5	544	N/A	7.6	0.35	0.62	7.53	12.16	5.08	5.57	0.20
GCP N1-Standard-4-Win	213.9	681.6	1545	594	8.09	0.3	0.6	3.93	7.04	4.86	6.08	0.39
GCP E2-Standard-2-Win	188.8	360.6	736	N/A	7.53	0.35	0.62	6.89	11.85	7.56	6.24	0.16
GCP E2-Standard-4-Win	225.2	701	1626	637	8.01	0.3	0.61	4.19	7.09	5.34	6.15	0.32
GCP N2d-Standard-2-Win	275.7	538.7	1163	N/A	8.46	0.29	0.58	3.71	6.60	3.56	4.68	0.18
GCP N2d-Standard-4-Win	343.8	1054	2523	882	8.62	0.29	0.57	2.29	4.12	1.81	4.39	0.36
GCP custom-2-4096-Win	170	315	691	N/A	7.5	0.34	0.65	7.87	11.16	8.17	6.63	0.18
Physical PC									ruben@fra.me			
Workstation-RSP	647	6461	13674	1463	9.22	0.29	0.63	3.71	6.90	0.71	0.74	N/A
Nutanix AHV									ruben@fra.me			
AIR8GB - OVH	393.6	1377	3151	815	8.52	0.3	0.65	2.24	3.51	1.8	3.19	N/A

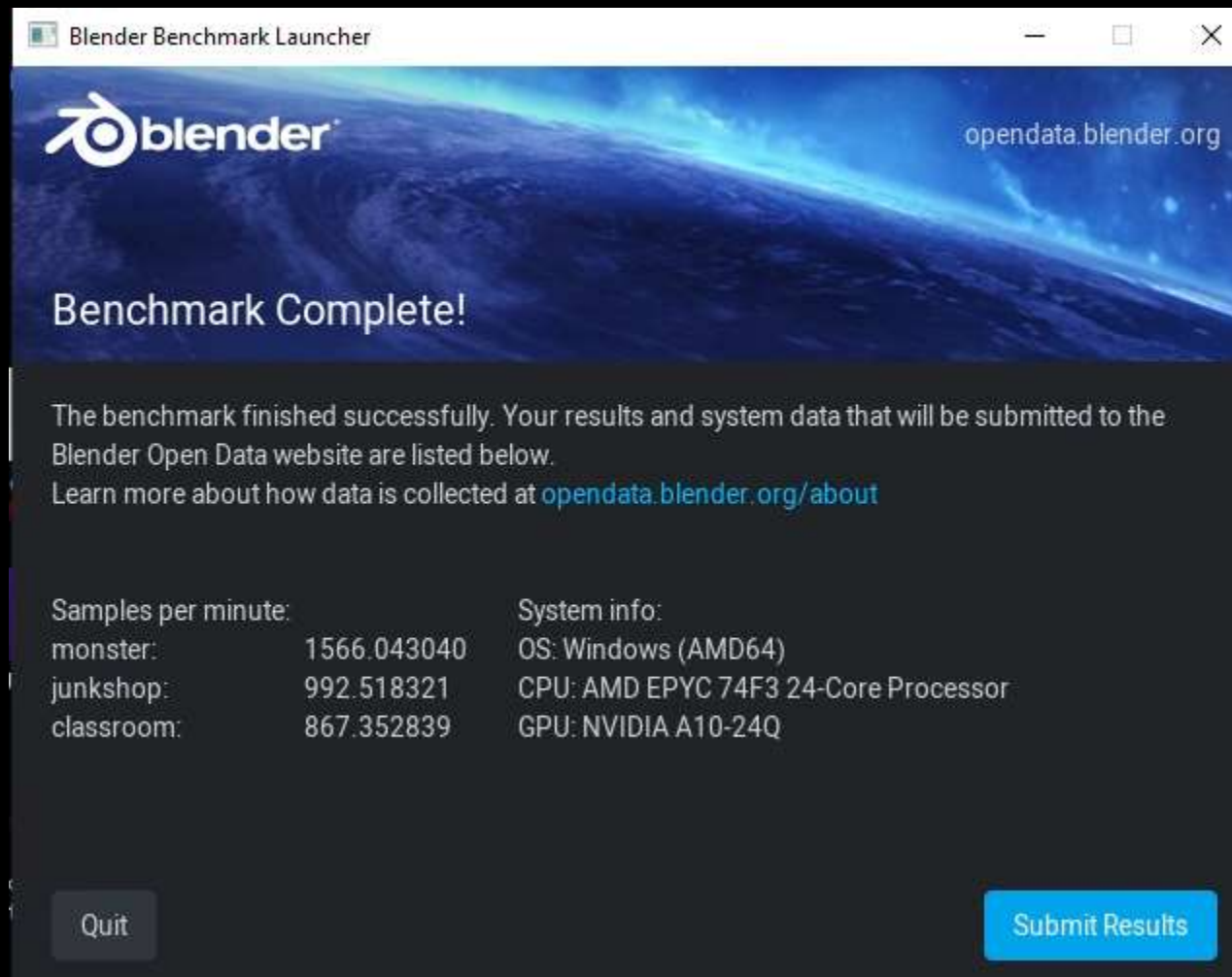
CPU INSTANCE PERFORMANCE/COSTS OBSERVATIONS

- Azure: Use v5 machine instead of v3 – 25% better performance and slightly lower price
- AWS: Use the m6i.larger instead t3.large when available – same price, better CPU performance
- Azure machines in favor of AWS – same price but better CPU performance
- GCP overall cheapest but also lowest CPU performance
- If applications are less CPU demanding, then GCP is in favor because of attractive price compared to Azure/AWS



Cloud Workstations with GPU





Blender BenchMark

SPECviewperf® 2020 Results

<http://www.spec.org/gwpg>

Composite Scores (1920x1080)

SPECviewperf measures the frame rate, or frames per second (FPS), at which your graphics card can render scenes across a wide variety of applications and usage models. Each viewset represents an application or a usage model, and each composite score below is based on a weighted geometric mean of many different scenes and rendering modes.

Composites by Viewset

To explore a viewset in more detail, including the measured frame rate for each test of which the composite score is comprised, click on the viewset name in the menu to the left.

Viewset	Composite Score	Window
3dsmax-07	144.37	1900 x 1060
catia-06	97.79	1900 x 1060
creo-03	108.25	1900 x 1060
energy-03	86.31	1900 x 1060
maya-06	419.07	1900 x 1060
medica-06	74.63	1900 x 1060
solidworks-07	259.86	1904 x 1060

SPECViewPerf 2020

Instance	CPU	CPU Base Clock Speed	Max CPU Speed - single-core	vCPUs	RAM	Storage Type	Storage Size	GPU	GPU RAM	GPU Driver	Display	OS
Microsoft Azure												
Azure NV6	Intel Xeon E5-2690v3 - Haswell	2.6 GHz	3.5 GHz	6	56 GiB	Standard-SSD	256GB	NVIDIA M60	8 GB	512.78	FHD	Win10 22H2
Azure NV4as_v4	AMD EPYC 7V12 - Rome	2.45 GHz	3.3 GHz	4	14 GiB	Premium-SSD	256GB	AMD MI25	2 GB	22.10.01.1	FHD	Win10 22H2
Azure NV8as_v4	AMD EPYC 7V12 - Rome	2.45 GHz	3.3 GHz	8	28 GiB	Premium-SSD	256GB	AMD MI25	4 GB	22.10.01.1	FHD	Win10 22H2
Azure NV16as_v4	AMD EPYC 7V12 - Rome	2.45 GHz	3.3 GHz	16	56 GiB	Premium-SSD	256GB	AMD MI25	8 GB	22.10.01.1	FHD	Win10 22H2
Azure NV32as_v4	AMD EPYC 7V12 - Rome	2.45 GHz	3.3 GHz	32	112 GiB	Premium-SSD	256GB	AMD MI25	16 GB	22.10.01.1	FHD	Win10 22H2
Azure NC4asT4_v3	AMD EPYC 7V12 - Rome	2.45 GHz	3.3 GHz	4	28 GiB	Premium-SSD	256GB	NVIDIA T4	16 GB	512.78	FHD	Win10 22H2
Azure NC8asT4_v3	AMD EPYC 7V12 - Rome	2.45 GHz	3.3 GHz	8	56 GiB	Premium-SSD	256GB	NVIDIA T4	16 GB	512.78	FHD	Win10 22H2
Azure NC16asT4_v3	AMD EPYC 7V12 - Rome	2.45 GHz	3.3 GHz	16	110 GiB	Premium-SSD	256GB	NVIDIA T4	16 GB	512.78	FHD	Win10 22H2
Azure NV6adsA10_v5	AMD EPYC 74F3 - Milan	3.2 GHz	4.0 GHz	6	55 GiB	Premium-SSD	256GB	NVIDIA A10 4Q	4 GB	512.78	FHD	Win10 22H2
Azure NV12adsA10_v5	AMD EPYC 74F3 - Milan	3.2 GHz	4.0 GHz	12	110 GiB	Premium-SSD	256GB	NVIDIA A10 8Q	8 GB	512.78	FHD	Win10 22H2
Azure NV36adsA10_v5	AMD EPYC 74F3 - Milan	3.2 GHz	4.0 GHz	36	440 GiB	Premium-SSD	256GB	NVIDIA A10 24Q	24 GB	512.78	FHD	Win10 22H2
Azure NG8ads_V620_v1	AMD EPYC 7763 - Genoa	2.45 GHz	3.5 GHz	8	16 GiB	Premium-SSD	256GB	AMD V620 1/4	8 GB	23.Q3	FHD	Win10 22H2
Azure NG16ads_V620_v1	AMD EPYC 7763 - Genoa	2.45 GHz	3.5 GHz	16	32 GiB	Premium-SSD	256GB	AMD V620 1/2	16 GB	23.Q3	FHD	Win10 22H2
Azure NG32ads_V620_v1	AMD EPYC 7763 - Genoa	2.45 GHz	3.5 GHz	32	64 GiB	Premium-SSD	256GB	AMD V620 1/1	32 GB	23.Q3	FHD	Win10 22H2
AWS												
AWS G4ad.XL	AMD EPYC 7R32 - Rome	2.8 GHz	3.3 GHz	4	16 GiB	EBS GP3	256GB	AMD V520	8 GB	30.0.21001	FHD	Server 2019
AWS G4ad.2XL	AMD EPYC 7R32 - Rome	2.8 GHz	3.3 GHz	8	32 GiB	EBS GP3	256GB	AMD V520	8 GB	30.0.21001	FHD	Server 2019
AWS G4ad.4XL	AMD EPYC 7R32 - Rome	2.8 GHz	3.3 GHz	16	64 GiB	EBS GP3	256GB	AMD V520	8 GB	30.0.21001	FHD	Server 2019
AWS G4ad.8XL	AMD EPYC 7R32 - Rome	2.8 GHz	3.3 GHz	32	128 GiB	EBS GP3	256GB	AMD V520 x2	8 GB	30.0.21001	FHD	Server 2019
AWS G4dn.XL	Intel Xeon 8259 - Cascade Lake	2.5 GHz	3.5 GHz	4	16 GiB	EBS GP3	256GB	NVIDIA T4	16 GB	527.41	FHD	Server 2019
AWS G4dn.2XL	Intel Xeon 8259 - Cascade Lake	2.5 GHz	3.5 GHz	8	32 GiB	EBS GP3	256GB	NVIDIA T4	16 GB	527.41	FHD	Server 2019
AWS G4dn.4XL	Intel Xeon 8259 - Cascade Lake	2.5 GHz	3.5 GHz	16	64 GiB	EBS GP3	256GB	NVIDIA T4	16 GB	527.41	FHD	Server 2019
AWS G4dn.8XL	Intel Xeon 8259 - Cascade Lake	2.5 GHz	3.5 GHz	32	128 GiB	EBS GP3	256GB	NVIDIA T4	16 GB	527.41	FHD	Server 2019
AWS G5.xl	AMD EPYC 7R32 - Rome	2.8 GHz	3.3 GHz	4	16 GiB	EBS GP3	256GB	NVIDIA A10G	24 GB	527.41	FHD	Server 2019
AWS G5.2xl	AMD EPYC 7R32 - Rome	2.8 GHz	3.3 GHz	8	32 GiB	EBS GP3	256GB	NVIDIA A10G	24 GB	527.41	FHD	Server 2019
AWS G5.4xl	AMD EPYC 7R32 - Rome	2.8 GHz	3.3 GHz	16	64 GiB	EBS GP3	256GB	NVIDIA A10G	24 GB	527.41	FHD	Server 2019
AWS G5.8xl	AMD EPYC 7R32 - Rome	2.8 GHz	3.3 GHz	32	128 GiB	EBS GP3	256GB	NVIDIA A10G	24 GB	527.41	FHD	Server 2019
GCP												
GCP N1-STD-2-GPU-T4	Intel Xeon 3647 - Skylake	2.0 GHz	3.5 GHz	2	8 GiB	Zonal SSD PD	256GB	NVIDIA T4	16 GB	528.24	FHD	Server 2019
GCP N1-STD-4-GPU-T4	Intel Xeon 3647 - Skylake	2.0 GHz	3.5 GHz	4	16 GiB	Zonal SSD PD	256GB	NVIDIA T4	16 GB	528.24	FHD	Server 2019
GCP N1-STD-8-GPU-T4	Intel Xeon 3647 - Skylake	2.0 GHz	3.5 GHz	8	30 GiB	Zonal SSD PD	256GB	NVIDIA T4	16 GB	528.24	FHD	Server 2019
GCP N1-STD-16-GPU-T4	Intel Xeon 3647 - Skylake	2.0 GHz	3.5 GHz	16	60 GiB	Zonal SSD PD	256GB	NVIDIA T4	16 GB	528.24	FHD	Server 2019
Physical PC												
Workstation-RSP	AMD Ryzen 7 5800X	3.8 GHz	4.7 GHz	16	128 GB	NVMe	2TB	NVIDIA RTX A6000	48 GB		FHD	Win 11 22-H2

Instance						Blender						EUC				SPEC										Price	
	CPUZ - ST	CPUZ - MT	CBR23 - MC	CBR23 - SC	EUX 2023	CPU Monster	CPU Junkshop	CPU Class	GPU Monster	GPU Junkshop	GPU Class	Score App Dialog	EUC Score App Start	EUC Score GDI+ Dragon	EUC Score Tree	EUC Score Rect	EUC Score IOPS	SPEC 2020 3dsmax	SPEC 2020 catia	SPEC 2020 creo	SPEC 2020 energy	SPEC 2020 maya	SPEC 2020 medical	SPEC 2020 smx	SPEC 2020 solidw		
Microsoft Azure																											
Azure NV6	256	1789	3843	671	7.37	26.73	16.21	14.2	157	97	79	0.28	0.62	8.71	15.31	1.55	5.57	44.67	43.35	67.31	23.05	151.39	24.73	194	96	1.33	
Azure NV4as_v4	348	997	2304	893	7.95	15.63	9.09	7.8	FAIL	FAIL	FAIL	0.29	0.68	106.89	194.31	1.3	14.08	4.09	4.10	4.22	1.42	12.72	2.22	28	11	0.47	
Azure NV8as_v4	375	2107	4673	937	8.25	33.4	19.53	16.55	78	16	30	0.29	0.65	26.52	49.36	1.05	6.34	9.99	11.95	19.70	25.87	35.47	7.05	59	27	0.94	
Azure NV16as_v4	395.7	4246	9445	945	8.03	66.53	40.07	32.68	162	56	79	0.29	0.66	10.36	20.83	1.3	3.98	23.53	23.64	37.92	37.22	86.62	14.41	120	56	1.88	
Azure NV32as_v4	395.4	8414	17896	959	8.37	134.32	80.9	67.02	358	148	197	0.29	0.65	4.3	8.96	1.18	2.88	69.54	48.36	54.79	49.64	202.09	31.84	277	128	3.76	
Azure NC4asT4_v3	365.8	1490	2988	909	8.22	21.24	12.38	11.04	725	485	465	0.28	0.61	4.21	8.58	1.08	11.3	83.68	64.26	102.26	38.48	241.46	46.62	293	155	0.81	
Azure NC8asT4_v3	376.7	3059	7029	942	8.3	45.94	27.18	23.12	725	485	463	0.28	0.61	4.14	8.21	1.12	3.92	83.64	62.40	92.56	38.55	246.50	46.88	292	155	1.24	
Azure NC16asT4_v3	395.9	6020	13959	956	8.28	90.92	55.74	47.12	709	471	466	0.28	0.61	4.52	8.87	1.16	3.67	84.00	59.04	80.78	39.10	248.49	47.17	295	158	2.14	
Azure NV6adsA10_v5	494.4	2105	4895	1273	8.41	32.72	19.74	16.09	FAIL	FAIL	FAIL	0.28	0.57	36.32	78.85	0.73	5.26	14.40	18.09	24.58	11.30	51.07	10.73	51	31	0.82	
Azure NV12adsA10_v5	511.7	4016	9818	1309	8.36	67.11	41.5	33.44	371	216	196	0.28	0.57	19.12	36.42	0.82	2.68	42.69	41.44	51.57	32.51	125.94	21.93	109	67	1.63	
Azure NV36adsA10_v5	548.8	12821	26897	1310	8.4	199.24	125.35	97.6	1566	992	867	0.28	0.56	3.8	7.91	0.82	1.9	144.37	97.79	108.25	86.31	419.07	74.63	451	260	5.47	
Azure NG8ads_V620_v1	448.2	3472	8062	1053	8.00	54.92	34.5	27.13	249	132	118	0.3	0.75	20.97	39.23	0.99	6.73	32.85	39.13	54.25	27.41	203.58	26.76	122	94	1.41	
Azure NG16ads_V620_v1	455.8	7035	16079	1094	8.29	111.07	71.58	54.8	521	283	249	0.29	0.65	12.27	22.82	1.02	4.7	107.44	79.34	97.44	56.70	432.99	64.83	269	197	2.82	
Azure NG32ads_V620_v1	460.7	14182	31377	1097	8.00	111.98	72.68	54.77	1137	641	544	0.3	0.7	5.62	8.41	1.01	3.04	208.51	135.96	135.22	111.66	754.20	128.12	561	322	5.64	
AWS																											
AWS G4ad.XL	316	960	2317	898	8.45	15.14	9.2	7.55	FAIL	FAIL	FAIL	0.3	0.6	7.67	12.37	2.49	8.12	42.09	28.09	34.43	41.64	157.69	29.45	246	121	0.58	
AWS G4ad.2XL	334	1991	4663	923	8.55	31.33	18.62	15.45	FAIL	FAIL	FAIL	0.31	0.59	5.59	13.83	1.52	8.58	43.04	31.33	42.12	41.89	173.20	29.66	251	135	0.82	
AWS G4ad.4XL	342	4205	9564	956	8.62	65.6	40.76	32.4	FAIL	FAIL	FAIL	0.32	0.58	6.31	12.88	1.33	8.51	42.71	33.58	47.76	41.56	190.70	29.38	264	138	1.64	
AWS G4ad.8XL	354	7917	18173	943	8.61	132	83.06	64.94	FAIL	FAIL	FAIL	0.3	0.59	6.3	13.16	1.37	8.47	41.12	34.26	49.41	42.08	175.69	29.67	269	140	1.64	
AWS G4dn.XL	296	859	1615	744	8.32	11.62	7.34	5.59	636	396	367	0.28	0.59	4.87	10.46	1.48	8.3	75.83	56.16	94.43	36.61	193.65	45.89	288	138	0.79	
AWS G4dn.2XL	334	1804	3949	786	8.44	25.43	16.59	12.1	640	400	375	0.28	0.58	4.91	9.04	1.33	8.73	77.55	57.77	101.04	36.04	195.34	45.30	276	137	1.23	
AWS G4dn.4XL	342	3566	8117	785	8.6	53.09	34.05	25.04	643	405	376	0.29	0.57	4.37	8.35	1.12	8.3	77.30	58.61	102.83	35.45	202.16	45.00	272	137	2.19	
AWS G4dn.8XL	345	7290	16195	816	8.61	109	71.63	52.48	636	397	367	0.28	0.57	4.4	8.03	1.13	7.18	78.04	56.12	102.91	33.38	193.24	44.11	275	147	4.10	
AWS G5.xl	320.3	1008	2299	919	8.4	16.03	9.2	7.81	1483	914	821	0.28	0.59	5.48	10.97	1.48	7.92	145.16	94.78	100.43	102.19	352.26	76.11	464	244	1.23	
AWS G5.2xl	320.8	2090	4614	928	8.61	30.98	19.13	15.83	1515	944	843	0.28	0.58	5.35	9.9	1.2	8.52	140.76	98.00	109.27	103.27	359.78	74.97	473	265	1.63	
AWS G5.4xl	374	4306	9509	887	8.63	65.31	40.47	32.43	1502	942	850	0.29	0.57	4.56	8.51	1.15	8.62	142.71	101.73	117.42	104.03	375.98	77.06	482	272	2.42	
AWS G5.8xl	371	8692	18484	965	8.61	132.43	82.46	65.76	1519	933	839	0.28	0.57	4.35	8.74	1.42	8.42	142.95	102.61	117.19	103.98	376.15	77.38	488	273	4.01	
GCP																											
GCP N1-STD-2-GPU-T4	195	402	869	FAIL	8.5	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	0.31	0.62	8.48	16.08	4.63	5.05	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	1.36
GCP N1-STD-4-GPU-T4	262.8	803.5	1456	694	8.55	12.2	7.16	5.64	FAIL	FAIL	FAIL	0.29	0.6	6.43	15.27	1.56	4.46	73.25	51.12	81.95	34.93	170.11	42.98	266	134	1.65	
GCP N1-STD-8-GPU-T4	269.4	1566	3419	707	8.65	22.54	13.77	10.9	608	382	347	0.29	0.58	5.98	12.43	1.5	3.13	73.81	52.22	88.14	34.97	180.27	44.00	272	136	4.02	
GCP N1-STD-16-GPU-T4	275.5	3190	6966	694	8.63	45.72	29.69	21.75	630	382	356	0.29	0.58	6.62	12.07	1.31	3.17	73.55	52.84	90.59	34.39	179.02	43.68	269	135	8.52	
Physical PC																											
Workstation-RSP	12	647	6461	13674	1463	9.22	99.22	63.58	49.49	2608	1625	1446	0.29	0.63	3.71	6.9	0.71	0.74	206.64	157.05	157.25	129.16	528.00	93.11	665	403	N/A



Date: 10/31/2023
 Author: ruben@fra.me
 Version: v10312023

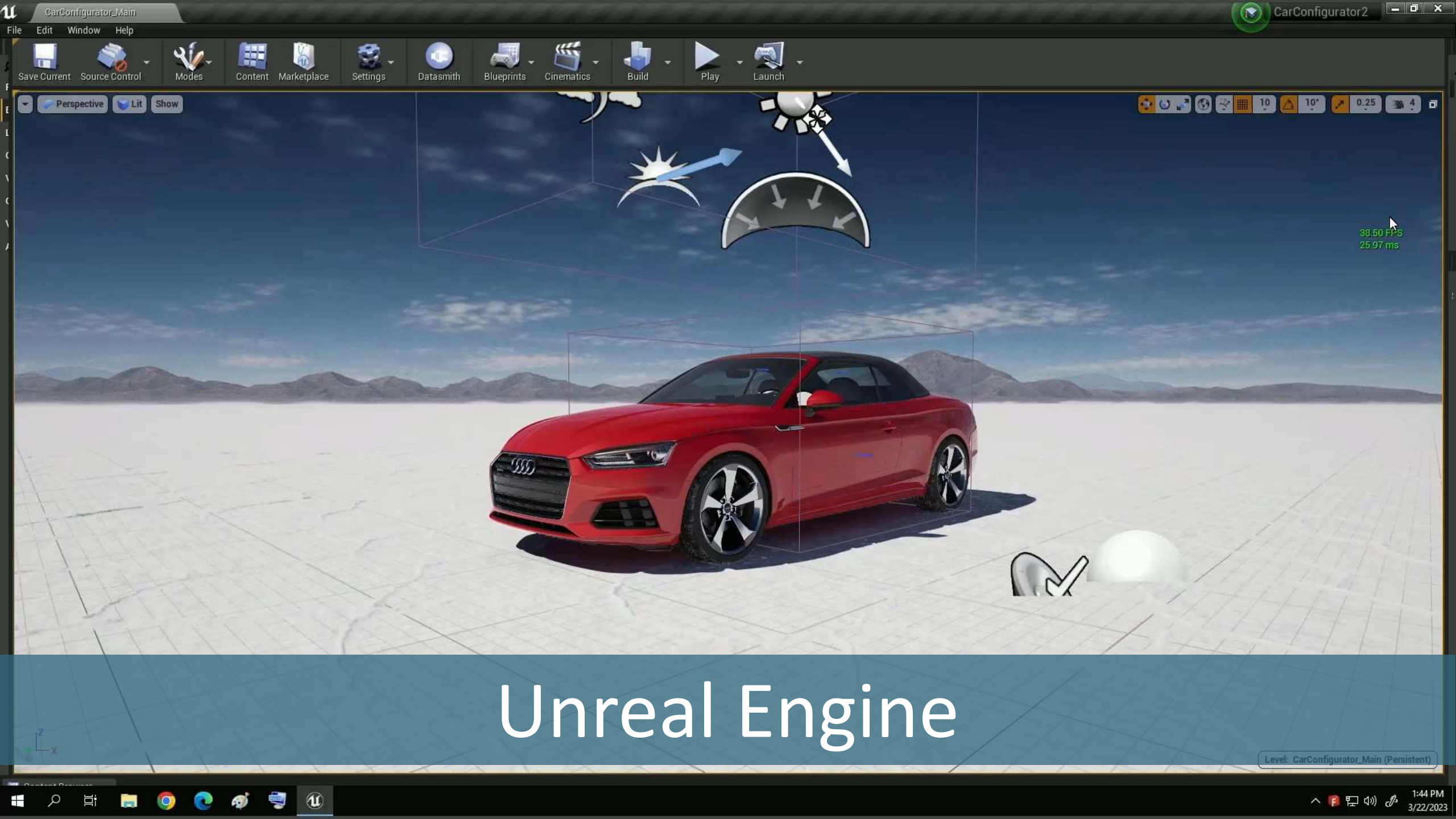
Notes: Results are indication - not exact science
 results might vary
 Copyright, contact us if you want to use content

Notes about pricing:

Price \$/hour
 On-demand pricing
 Average compute price across all regions
 Windows OS License included
 Storage costs not included

A modern workstation setup on a wooden desk. A large monitor displays a 3D architectural visualization of a complex, crystalline structure. To the left, a desk lamp is positioned. To the right, a tower PC case is visible. The background shows a blurred office environment with windows and framed pictures on the wall.

AEC use-case CAD – BIM – Visualization



Unreal Engine

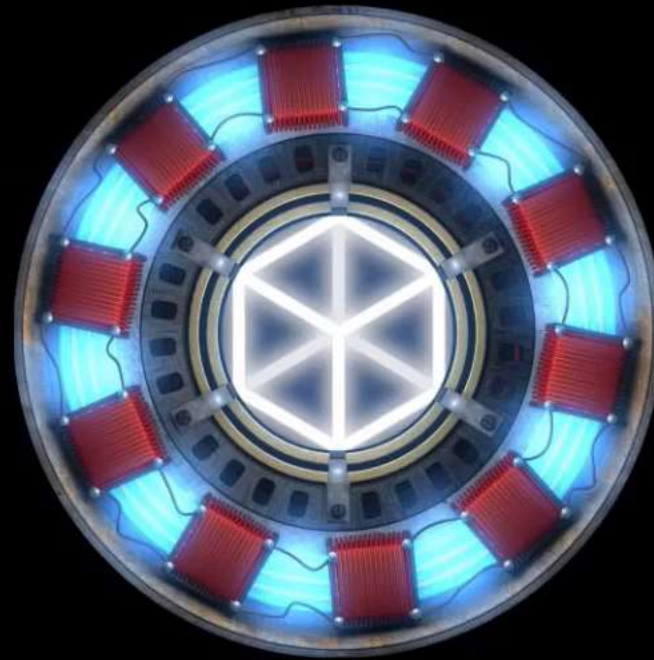
38.50 FPS
25.97 ms

Level: CarConfigurator_Main (Persistent)

1:44 PM
3/22/2023



Autodesk VRED

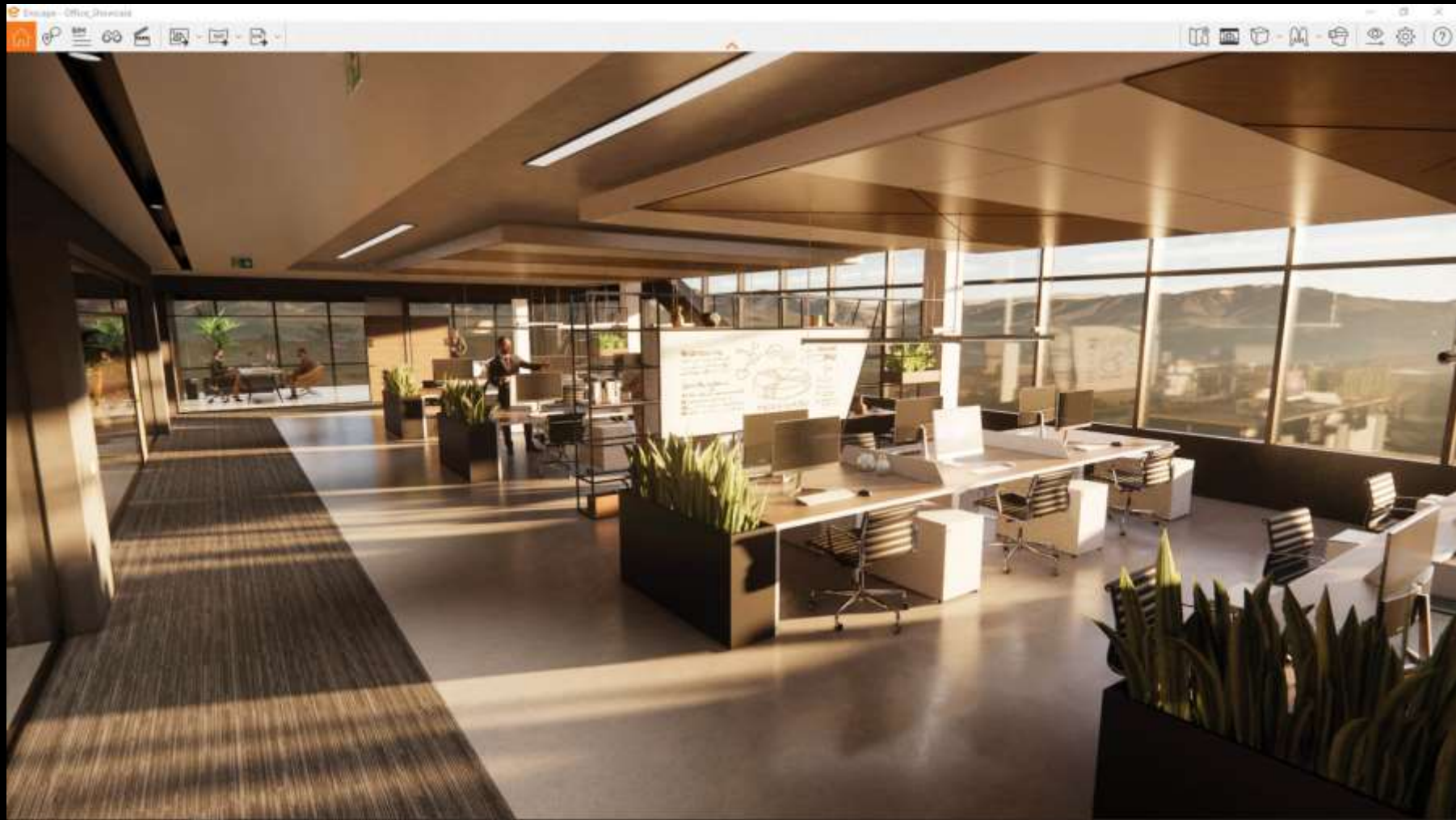


Frame

Autodesk Revit - RFOMark



KeyShot



Enscape



V-Ray

Instance	CPU	CPU Base Clock Speed	Max CPU Speed - single-core	vCPUs	RAM	Storage Type	Storage Size	GPU	GPU RAM	GPU Driver	Display	OS
Microsoft Azure								ruben@fra.me				
Azure NV6_v3	Intel Xeon E5-2690v3 - Haswell	2.60 GHz	3.5 GHz	6	55 GiB	Standard-SSD	256GB	NVIDIA M60	8GB	512.78	FHD	Win10 22H2
Azure NV12_v3	Intel Xeon E5-2690v3 - Haswell	2.60 GHz	3.5 GHz	12	112 GiB	Standard-SSD	256GB	NVIDIA M60	8GB	512.78	FHD	Win10 22H2
Azure NV8as_v4	AMD EPYC 7V12 - Rome	2.45 GHz	3.3 GHz	8	28 GiB	Premium-SSD	256GB	AMD MI25	4GB	22.10.01.11	FHD	Win10 22H2
Azure NV16as_v4	AMD EPYC 7V12 - Rome	2.45 GHz	3.3 GHz	16	56 GiB	Premium-SSD	256GB	AMD MI25	8GB	22.10.01.11	FHD	Win10 22H2
Azure NC4asT4_v3	AMD EPYC 7V12 - Rome	2.45 GHz	3.3 GHz	4	28 GiB	Premium-SSD	256GB	NVIDIA T4	16GB	512.78	FHD	Win10 22H2
Azure NC8asT4_v3	AMD EPYC 7V12 - Rome	2.45 GHz	3.3 GHz	8	56 GiB	Premium-SSD	256GB	NVIDIA T4	16GB	512.78	FHD	Win10 22H2
Azure NC16asT4_v3	AMD EPYC 7V12 - Rome	2.45 GHz	3.3 GHz	16	110 GiB	Premium-SSD	256GB	NVIDIA T4	16GB	512.78	FHD	Win10 22H2
Azure NV6adsA10_v5	AMD EPYC 74F3 - Milan	3.2 GHz	4.0 GHz	6	55 GiB	Premium-SSD	256GB	NVIDIA A10 4Q	4GB	512.78	FHD	Win10 22H2
Azure NV12adsA10_v5	AMD EPYC 74F3 - Milan	3.2 GHz	4.0 GHz	12	110 GiB	Premium-SSD	256GB	NVIDIA A10 8Q	8GB	512.78	FHD	Win10 22H2
Azure NV36adsA10_v5	AMD EPYC 74F3 - Milan	3.2 GHz	4.0 GHz	36	440 GiB	Premium-SSD	256GB	NVIDIA A10 24Q	24GB	512.78	FHD	Win10 22H2
Azure NG8ads_V620_v1	AMD EPYC 7763 - Genoa	2.45 GHz	3.5 GHz	8	16 GiB	Premium-SSD	256GB	AMD V620 1/4	8 GB	23.Q3	FHD	Win10 22H2
Azure NG16ads_V620_v1	AMD EPYC 7763 - Genoa	2.45 GHz	3.5 GHz	16	64 GiB	Premium-SSD	256GB	AMD V620 1/12	16 GB	23.Q3	FHD	Win10 22H2
Azure NG32ads_V620_v1	AMD EPYC 7763 - Genoa	2.45 GHz	3.5 GHz	32	64 GiB	Premium-SSD	256GB	AMD V620 1/1	32 GB	23.Q3	FHD	Win10 22H2
AWS								ruben@fra.me				
AWS G4ad.XL	AMD EPYC 7R32 - Rome	2.8 GHz	3.3 GHz	4	16 (GiB)	EBS GP3	256GB	AMD V520	8GB	30.0.21001.12042	FHD	Server 2019
AWS G4ad.2XL	AMD EPYC 7R32 - Rome	2.8 GHz	3.3 GHz	8	32 (GiB)	EBS GP3	256GB	AMD V520	8GB	30.0.21001.12042	FHD	Server 2019
AWS G4ad.4XL	AMD EPYC 7R32 - Rome	2.8 GHz	3.3 GHz	16	64 (GiB)	EBS GP3	256GB	AMD V520	8GB	30.0.21001.12042	FHD	Server 2019
AWS G4dn.XL	Intel Xeon 8259 - Cascade Lake	2.5 GHz	3.5 GHz	4	16 (GiB)	EBS GP3	256GB	NVIDIA T4	16GB	527.41	FHD	Server 2019
AWS G4dn.2XL	Intel Xeon 8259 - Cascade Lake	2.5 GHz	3.5 GHz	8	32 (GiB)	EBS GP3	256GB	NVIDIA T4	16GB	527.41	FHD	Server 2019
AWS G4dn.4XL	Intel Xeon 8259 - Cascade Lake	2.5 GHz	3.5 GHz	16	64 (GiB)	EBS GP3	256GB	NVIDIA T4	16GB	527.41	FHD	Server 2019
AWS G4dn.12XL	Intel Xeon 8259 - Cascade Lake	2.5 GHz	3.5 GHz	48	192 (GiB)	EBS GP3	256GB	NVIDIA T4 x 4	16GB x 4	527.41	FHD	Server 2019
AWS G5.xl	AMD EPYC 7R32 - Rome	2.8 GHz	3.3 GHz	4	16 (GiB)	EBS GP3	256GB	NVIDIA A10G	24GB	527.41	FHD	Server 2019
AWS G5.2xl	AMD EPYC 7R32 - Rome	2.8 GHz	3.3 GHz	8	32 (GiB)	EBS GP3	256GB	NVIDIA A10G	24GB	527.41	FHD	Server 2019
AWS G5.4xl	AMD EPYC 7R32 - Rome	2.8 GHz	3.3 GHz	16	64 (GiB)	EBS GP3	256GB	NVIDIA A10G	24GB	527.41	FHD	Server 2019
AWS G5.8xl	AMD EPYC 7R32 - Rome	2.8 GHz	3.3 GHz	32	128 (GiB)	EBS GP3	256GB	NVIDIA A10G	24GB	527.41	FHD	Server 2019
GCP								ruben@fra.me				
GCP N1-STD-4-GPU-T4	Intel Xeon 3647 - Skylake	2.0 GHz	3.5 GHz	4	16 (GiB)	Zonal SSD PD	256GB	NVIDIA T4	16GB	528.24	FHD	Server 2019
GCP N1-STD-8-GPU-T4	Intel Xeon 3647 - Skylake	2.0 GHz	3.5 GHz	8	30 (GiB)	Zonal SSD PD	256GB	NVIDIA T4	16GB	528.24	FHD	Server 2019
Physical Workstation								ruben@fra.me				
HP Z2 Mini G9	Intel Core i7-12700K	3.6 GHz	5.0 GHz	8P - 4E	32 GB	SSD	1TB	NVIDIA T1000	4GB	511.65	FHD	Win11
Scan 3XS GWP-ME A13C	Intel Core i9-13900K	3.0 GHz	5.8 GHz	8P-16E	64 GB	NVMe	2TB	NVIDIA RTX A2000	12GB	517.4	FHD	Win11
Armari Magnetar M64TP-RW1300G3	AMD Ryzen Threadripper Pro 5995WX	2.7 GHz	4.5 GHz	64	128 GB	NVMe	2TB	AMD Radeon Pro W6800	32GB	22.Q3	FHD	Win11
Scan 3XS GWP-ME A1128T	AMD Ryzen Threadripper Pro 5995WX	2.7 GHz	4.5 GHz	64	128 GB	NVMe	2TB	NVIDIA RTX 6000 ada	48GB	528.24	FHD	Win11

Instance	vRay 5 - CPU	vRay 5 - Keyshot RTX GPU	Keyshot 11 - CPU	Keyshot 11 - GPU	Revit 2021 RFO - update (sec)	Revit 2021 RFO - create (sec)	Revit 2021 RFO - export (sec)	Revit 2021 RFO - Render (sec)	Revit 2021 RFO - Graphics (sec)	Revit 2021 RFO - Rotate (sec)	VRED 2023 - no AA	VRED 2023 - med AA	VRED 2023 - ultra high AA	Escape 3.1 - sample	Unreal Engine 4.26 Audi - RT ON	Unreal Engine 4.26 Audi - RT OFF	Inventor 2023 - Modelling	Inventor 2023 - Drawing	Inventor 2023 - FEA	Inventor 2023 - SIM	Inventor 2023 - Graphics	Inventor 2023 - RT	Inventor 2023 - Data Translate	Inventor 2023 - Assy Pattern	Inventor 2023 - Assy Constraint	Inventor 2023 - ST	Inventor 2023 - MT	Price	
Microsoft Azure																													

Cloud workstations for CAD, BIM and visualisation
How the major public cloud providers stack up

In-depth technical report

Using Fusion, the Desktop-as-a-Service (DaaS) solution, we test 23 GPU-accelerated instances from Amazon Web Services (AWS), Google Cloud Platform (GCP), and Microsoft Azure, in terms of raw performance and end user experience.

By Greg Corke

While benchmarking helps us understand the relative performance of different VaaS, it doesn't consider what happens between the subscription and the end user

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Autor: Greg Corke, DEVELOP3D's Managing Editor and resident workstation specialist

<https://aecmag.com/workstations/summer-2023-workstation-special-report/>

GPU INSTANCE PERFORMANCE/COSTS OBSERVATIONS

- Azure NVv4 machines with SPEC is not great performance; Low 3D performance, no video encoding / no hardware encoding exposed
- Azure NV4v4 is limited in fps (18 is max)
- Azure NV4v4 GPU compute is bad compared to CPU, the CPU outperforms the GPU looking at EUC Score 'Tree' and 'Dragon'
- Azure NVv4 CPU/Price performance is good – cheap & decent CPU performance
- Azure NVv4 if you don't need a GPU ... don't go for the cheap accelerated VM (NV4v4/NV8v4) use e.g., D4s_v5

GPU INSTANCE PERFORMANCE/COSTS OBSERVATIONS

- Azure NC8asT4 (NVIDIA T4) – if you don't need the vCPUs or RAM – go for the NC4asT4 – same GPU; SPEC performance almost the same, 30% cheaper
- Azure NV6adsA10 (NVIDIA A10 GPU) more CPU and RAM at the same price as the NC4asT4; NC4asT4 provides much better GPU performance because of full GPU vs GPU partition
- If you need GPU performance, don't use Azure NVadsA10 with smaller GPU partitions; the NCasT4 with dedicated GPU provides better performance.
- Azure NVadsA10 (NVIDIA A10 GPU) has high base clock speed – 3.2 GHz
- Azure NGads_V620 (AMD V620 GPU) has great CPU and GPU; Performance is great!
- Azure NGads_V620 (AMD V620 GPU) price isn't as low as expected (since no GPU licensing). Perf/Watt here
- Winner on Azure: NC4/NC8asT4 – Great price/perf ratio – dedicated GPU!
- If you have still the NV6/NV12 running switch to NC4/NC8 – migrate away;

GPU INSTANCE PERFORMANCE/COSTS OBSERVATIONS

- AWS G4ad (AMD V520 GPU) do have a very good performance/price ratio
- AWS G4ad (AMD V520 GPU) does not provide the highest GPU performance but decent
- AWS G5 (NVIDIA A10) outstanding performance also compared to Azure
- GCP has the best performing GPU (Ada LoveLace L4) at this moment
- GCP: CPU performance is limiting – why is it 2.0GHz ...
- GCP: Double the price compared to AWS (G4dn) – Azure (NC4v4) and lower (CPU) performance – not great!
- Check GPU availability
 - Azure: <https://azure.microsoft.com/en-us/explore/global-infrastructure/products-by-region/?products=virtual-machines®ions=all>
 - AWS: <https://instances.vantage.sh/>
 - GCP: <https://cloud.google.com/compute/docs/gpus/gpu-regions-zones>

CHECK GPU AVAILABILITY E.G.AZURE

Products	North Europe	West Europe	France Central	France South	Germany North	Germany West Central	Italy North	Norway East	Norway West	Sweden Central
NC A100 v4 Series	✓	✓	✓							✓
NCasT4v3-series	✓	✓				✓	✓			✓
NCsv2-series		✓								
NCsv3-series	✓	✓	✓							
ND A100 v4 Series		✓								
NDm A100 v4 Series		✓								
NDs-series		✓								
NDv2-series		✓								
NG_V620-v1-series	⬇	□								□
NP-series		✓								
NV-series	✓	✓								
NVads A10 v5 series	✓	✓	✓			✓				✓
NVv3-series	✓	✓	✓					✓	✓	
NVv4-series	✓	✓				✓				

HIGH-END CLOUD WORKSTATIONS

- Cloud Workstations beat the 2–4-year-old CAD/CAM workstations
- Cloud Workstation cannot beat physical Workstation in performance GPU in Cloud is years behind; CPU often has lower CPU clock speed compared to physical workstation or datacenter HCI
- Very few people need extremely high-end workstations
- Performance is only one (key) topic in decision-making

A complex network diagram with numerous white nodes and blue connecting lines, set against a dark blue background. The network is dense and interconnected, with lines radiating from several central nodes.

System Performance

User Experience

User Experience and Performance Data

IaaS: AWS, Azure, GCP GPU instances

Apps: Autodesk Revit, Inventor, VRED, Unreal Engine and Enscape

Network: LAN, WAN (2/4/8 Mbps – 10/60/110ms RTT)

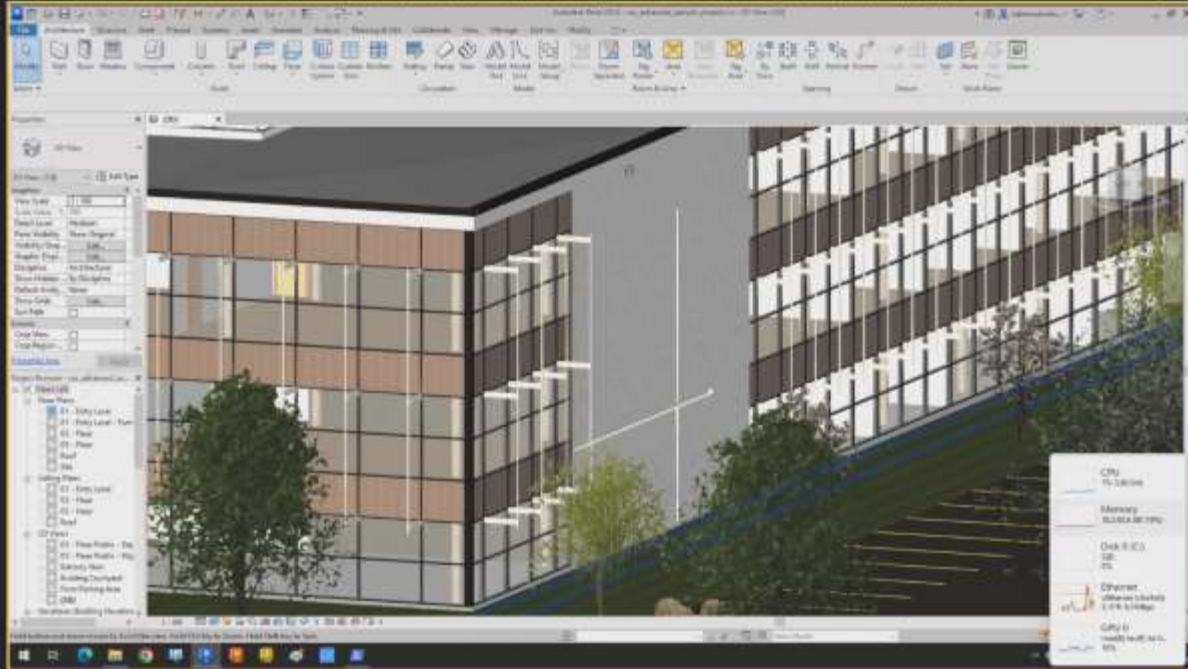
Resolution: Full HD and 4K resolution

Color space: YUV420 & YUV444

Results: 40+ studies, 200+ scores

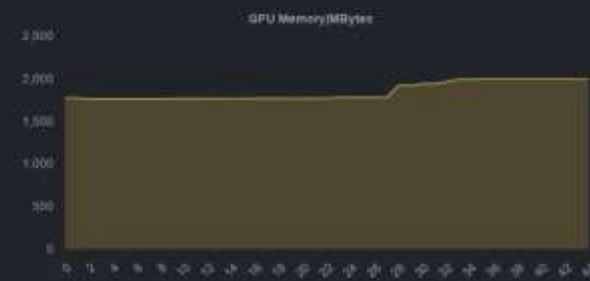
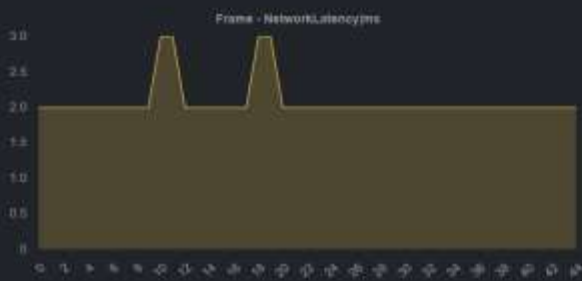
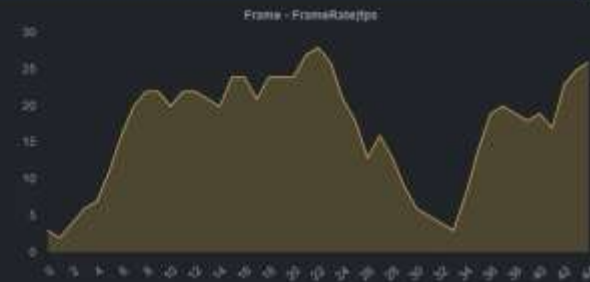
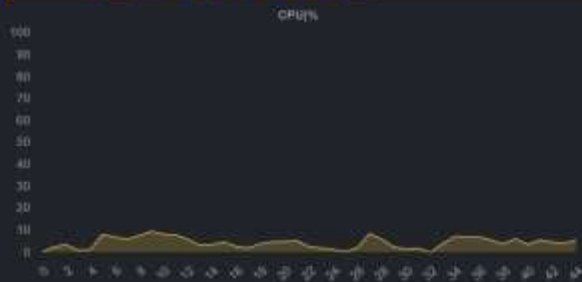
SL-Autodesk-Revit on Azure NG32ads-v620-v1, 32vCPU, 64GiB, AMD V620 32GB | Frame-FRP8-UDP, 444 | 10ms RTT, 100Mbps | FHD

SL-Autodesk-Revit on Azure NG32ads-v620-v1, 32vCPU, 64GiB, AMD V620 32GB | Frame-FRP8-UDP, 444 | 10ms RTT, 100Mbps | FHD



```

00:00:01.000 Date: 2023/05/03 Time: 09:30:00.000 AppName: Unknown
00:00:01.015 SL-Dummy: Start custom workload
00:00:11.000 10 seconds
00:00:21.000 20 seconds
00:00:31.000 30 seconds
00:00:41.000 40 seconds
    
```



Seeing is believing.

Welcome to our user experience page where you'll find recorded Frame sessions showing the actual user experience compared to VM performance analytics across a variety of scenarios (infrastructure, instance types, network conditions, video quality, apps, etc.).



<https://ux.dizzion.com/>

Check out an extensive deep-dive into [Cloud workstations for CAD, BIM and visualization - How the major cloud providers stack up](#) from AEC Magazine.

"Using Frame, the Desktop-as-a-Service (DaaS) solution, we test 23 GPU-accelerated 'instances' from Amazon Web Services (AWS), Google Cloud Platform (GCP), and Microsoft Azure, in terms of raw performance and end user experience"

AECMAGAZINE

Author: [Greg Colke](#)



THANK YOU



Ruben Spruijt
Field CTO at Dizzion
ruben@dizzion.com

This FREE community event is made possible with support of:

