The science behind the report:

Undertake intensive projects with an HP Z6 G5 A Desktop Workstation powered by an AMD Ryzen Threadripper PRO 7975WX CPU

This document describes what we tested, how we tested, and what we found. To learn how these facts translate into real-world benefits, read the report Undertake intensive projects with an HP Z6 G5 A Desktop Workstation powered by an AMD Ryzen Threadripper PRO 7975WX CPU.

We concluded our hands-on testing on July 12, 2024. During testing, we determined the appropriate hardware and software configurations and applied updates as they became available. The results in this report reflect configurations that we finalized on May 23, 2024 or earlier. Unavoidably, these configurations may not represent the latest versions available when this report appears.

Our results

To learn more about how we have calculated the wins in this report, go to http://facts.pt/calculating-and-highlighting-wins. Unless we state otherwise, we have followed the rules and principles we outline in that document.

CPU benchmarks and hand-timed tasks

Table 1: Results of our CPU-focused benchmark testing and hand-timed tasks. Higher benchmark scores and ratings are better. For our hand-timed tasks, less time is better. All results are the median scores and times from three runs.

	HP Z6 G5 A Desktop Workstation	Dell™ Precision™ 7960 Tower Workstation
KeyShot® Benchmark 2024.1		
Score	9.45	7.00
Procyon® AI Computer Vision Benchmark - Microsoft ML - float32, gpu Procyon AI Version 1.17.1, Procyon UI Version 2.7.1169.64		
Overall score	**799**	**506**
MobileNet V3total inferences count	228,874	188,846
ResNet 50 total inferences count	89,291	64,890
Inception V4 total inferences count	31,161	22,592
DeepLab V3 inferences count	12,838	2,351
Real-ESRGAN	1,057	957
YOLO V3	19,135	11,356

	HP Z6 G5 A Desktop Workstation	Dell™ Precision™ 7960 Tower Workstation
Procyon Office Productivity Benchmark v. 2.1 Microsoft Office version 2405 Build 16.0.17628.20110, Procyon UI Version 2.7.1169.64		
Overall rating	**6,490**	**4,408**
Word	7,893	5,298
Excel	8,278	4,620
PowerPoint	7,234	4,325
Outlook	2,173	2,888
Pugetbench for After Effects benchmark Benchmark version v0.96.0, Adobe After Effects Version 24.5.0		
Overall score	1,395	833
Pugetbench for DaVinci Resolve benchmark Benchmark version 18.6.6, DaVinci Resolve version 0.93.1		
Score	2,757	2,047
Pugetbench for Premier Pro benchmark Benchmark version v 1.0.1, Premier Pro Version 24.5.0 (2024)		
Simple score	11,782	9,332
Extended score	8,720	5,100
Unreal Engine v. 5.4.2 project compilation hand-timed tasks (ss:ms)		
Build gaming project time (Lyra)	54.77	63.53
Build architectural project time (BArchivis)	23.76	29.13
Build video production project time (DRX)	21.36	25.39

CPU and GPU benchmarks and hand-timed tasks

Table 2: Results of our CPU- and GPU-focused benchmark testing and hand-timed tasks. Higher benchmark scores and ratings are better. For hand-timed tasks, less time is better. All results are the median scores and times from three runs.

	HP Z6 G5 A Desktop Workstation	Dell Precision 7960 Tower Workstation
3DMark benchmark v. 2.29.8256.64		
Fire Strike Extreme - overall score	**16,756**	**15,133**
Graphics	17,547	17,336
Physics	27,532	14,450
Time Spy Extreme - overall score	**7,530**	**6,721**
Graphics	6,780	6,425
CPU	20,208	9,100
Blender GPU benchmark 3.1.0		
Monster workload	2,317	2,105
The Junk Shop workload	1,097	1,034
Classroom workload	1,167	1,074

	HP Z6 G5 A Desktop Workstation	Dell Precision 7960 Tower Workstation
Chaos® V-Ray benchmark v. 6.00.01		
CPU	68,561	53,975
GPU - CUDA	2,383	2,387
GPU - RTX	3,779	3,760
CPU & GPU - CUDA	5,691	4,960
Cinebench 2024 benchmark v. 2024.1.0		
GPU	15,796	14,970
CPU multi-Core	3,499	2,450
CPU single-Core	109	96
GeekBench ML benchmark v. 0.6.0 using GPU		
ONNX DirectML inference score	18,831	12,413
Maxon redShiftBenchmark tool v. 3.6.01		
Time to complete (mm:ss)	02:44	02:57
Metashape Pro v. 2.1.2.18358 hand-timed tasks (mm:ss)		
Complete All tasks	**55:57**	**78:45**
Align photos task time	01:03	01:16
Build point cloud task time	43:18	60:24
Build mesh task time	07:50	11:21
Build texture task time	03:41	05:19
PassMark PerformanceTest 11.0 benchmark		
Overall rating	**15,460**	**11,900**
CPUMark value	96,822	61,072
2D GraphicsMark value	1,157	903
3D GraphicsMark value	29,566	26,247
MemoryMark value	3,482	2,506
DiskMark value	46,939	42,017
Procyon Photo Editing Benchmark Adobe Premiere Pro version 25.7.0, Adobe Lightroom Classic version 13.2, Procyon UL application version 2.8.1201, Photo Editing Benchmark version 1.2		
Score	8,317	5,023
Procyon Video Editing Benchmark Adobe Premiere Pro version 24.4.1.2, Procyon UI version 2.7.1169.64, Procyon Office version 1.2		
Score	9,600	6,976

	HP Z6 G5 A Desktop Workstation	Dell Precision 7960 Tower Workstation
MLPerf ResNet-50 inferencing benchmark		
Samples per second	**13,068.0**	**12,886.3**
Min latency (ns)	0.051	0.062
Max latency (ns)	681.0	693.5
Mean latency (ns)	339.8	346.3
Revit 2024.1 RFO Benchmark (mm:ss) RFO Benchmark version 3.4, Revit version 2024.2.10.64		
Model creation benchmark time	71.76	95.79
Render benchmark time	16.75	31.87
Graphics - Standard view time	18.84	30.14
Multitasking scenario- Revit modeling and Maya rendering (mm:ss) Revit version 2024.2.10.64, Maya version 2024.2		
Revit only - Building Render DPI 150 time	00:30	01:42
Maya only - 130 frame 4K export time	01:23	01:39
Revit and Maya simultaneous - Revit time	00:30	01:47
Revit and Maya simultaneous - Maya time	01:27	02:11
SPECapc® for Creo 9 benchmark SPECapc for Creo 9.0 version 9.10, PTC Creo Parametric version 9.0.8.0		
CPU Composite Score	**2.47**	**1.57**
GPU Composite Score	**2.26**	**1.28**
CPU	2.44	1.54
Render Studio CPU	3.94	2.61
CPU Convert	2.33	1.62
Shaded Graphics	2.21	1.33
Shaded Edge Graphics	2.06	1.03
Shaded Reflection Graphics	2.32	1.41
No Hidden Graphics	2.72	1.69
Hidden Graphics	2.79	1.47
SPECapc for Maya 2024 Benchmark Maya v. 2024.2		
CPU Composite Score	**18.74**	**13.81**
GPU Composite Score	**4.67**	**3.08**
GPU Shaded	3.61	2.10
GPU Shaded SSAO	5.09	3.50
GPU Wireframe on Shaded	4.33	2.95
GPU Wireframe on Shaded SSAO	5.05	3.58
GPU Textured	5.29	3.35

	HP Z6 G5 A Desktop Workstation	Dell Precision 7960 Tower Workstation
GPU Textured SSAO	5.14	3.48
CPU Arnold Raytrace	18.74	13.81
Evaluation Cache Composite	9.49	6.94
Animation Playback on CPU Evaluation Cache Disabled	5.16	3.51
Animation Playback on CPU Evaluation Cache Enabled	17.47	13.75
SPECapc for SolidWorks 2024 benchmark SPECapc for SolidWorks 2024 v. 2024.1.13, SolidWorks version SP3.1		
CPU Composite Score	**3.19**	**1.94**
GPU Composite Score	**2.49**	**2.26**
GPU Shaded	2.03	1.51
GPU Shaded With Edges	2.34	2.22
GPU Hidden Line Removal	3.98	3.85
GPU Shaded RealView	2.63	2.60
GPU Shaded RealView With Edges	2.93	2.90
GPU Drawing	1.88	1.44
CPU Raytrace	10.83	6.38
CPU Rebuild	2.52	1.34
CPU Convert	2.03	1.49
CPU Simulate	1.86	1.45
CPU Mass Properties	2.13	0.89
CPU Boolean	1.68	1.09
SPECviewperf® 2020 benchmark v. 3.1		
FHD (1,920 x 1,080 resolution)		
3dsmax-07	160.42	156.95
catia-06	133.31	115.42
creo-03	**192.04**	**132.77**
energy-03	97.67	98.40
maya-06	574.61	466.15
medical-03	141.18	141.05
snx-04	540.15	487.72
solidworks-07	351.67	330.54

	HP Z6 G5 A Desktop Workstation	Dell Precision 7960 Tower Workstation
4K (3,840 x 2,160 resolution)		
3dsmax-07	102.51	102.74
catia-06	79.24	66.71
creo-03	**136.41**	**107.61**
energy-03	32.32	32.65
maya-06	261.77	246.06
medical-03	54.60	54.67
snx-04	354.94	355.62
solidworks-07	133.23	133.68
SPECworkstation® 3.1.0 benchmark		
Media and Entertainment	**6.86**	**5.84**
CPU	7.95	6.55
Graphics	5.54	4.95
Storage	5.46	4.89
Product Development	**8.00**	**3.67**
Storage	9.66	2.96
Life Sciences	7.97	6.78
Graphics	**9.77**	**2.63**
Storage	17.47	16.83
Financial Services	**1.91**	**1.75**
CPU	15.03	10.26
Energy	**10.15**	**5.78**
CPU	10.33	4.77
Graphics	20.11	19.55
Storage	4.69	4.44
General Operations	**3.63**	**2.83**
Storage	2.91	2.16
GPU Compute	**6.23**	**6.00**
GPU	6.23	6.00

Thermal performance

Table 3: Results of our hands-on thermal testing while running a sustained 90-minute compute-intensive workload. Higher benchmark scores are better. Lower temperatures are better.

	HP Z6 G5 A Desktop Workstation		Dell Precision 7960 Tower Workstation	
CineBench 2024.1.0 benchmark results				
Multi-core score	3,482		2,468	
Average temperature	°C	°F	°C	°F
Ambient room temperature	21.8	71.24	21.9	71.42
PSU skin temperature	32.0	89.60	36.9	98.42
Chassis top	23.6	74.48	22.5	72.50
Chassis front panel	21.9	71.42	22.4	72.32
Rear fan, CPU exhaust	33.0	91.40	34.1	93.38

Acoustic performance

Table 4: Results of our hands-on acoustic testing while running a sustained 90-minute compute-intensive workload. Higher benchmark scores are better. Lower decibels are better.

	HP Z6 G5 A Desktop Workstation	Dell Precision 7960 Tower Workstation
CineBench 2024.1.0 - Sustained Performance over 90 minutes		
Multi-core score	3,432	2,378
Average sound produced over 30 minute load period, after a 60 minute warm-up period		
Decibels	58.0	54.7

System configuration information

Table 5: Detailed information on the systems we tested.

System configuration information	HP Z6 G5 A Desktop Workstation	Dell Precision 7960 Tower Workstation
BIOS name and version		
BIOS name and version	1.01.15	2.1.5
Windows Power Plan	HP Optimized (Default)	Balanced (Default)
Windows Power Mode	Best Performance	Best Performance
BIOS Performance Setting	Performance Control – Performance (Default)	Thermal Management – Optimized (Default)
Operating system		
Vendor	Microsoft	Microsoft
Name	Windows 11 Pro	Windows 11 Pro
Build number or version	23H2 (22631)	23H2 (22631)
Processor		
Vendor	AMD	Intel®
Model number	Ryzen™ Threadripper™ Pro 7975WX	Xeon® w9-3475X
Core frequency (MHz)	40.01	22.08
Number of cores	32	36
Cache (GB)	128	82.5
Discrete graphics		
Vendor	NVIDIA®	NVIDIA
Model number	RTX™ 4000 ADA Generation	RTX 4000 ADA Generation
VRAM (GB)	20	20
Memory module(s)		
Amount	128	128
Type	DDR5 SODIMM	DDR5 SODIMM
Speed (MHz)	5,600	4,800
Speed running in system (MHz)	5,200	4,800
Local storage A		
Amount (TB)	1	1
Type	NVMe®	NVMe
Local storage B		
Amount (TB)	NA	1
Type	NA	NVMe

System configuration information	HP Z6 G5 A Desktop Workstation	Dell Precision 7960 Tower Workstation
Local storage C		
Amount (TB)	NA	1.8
Type	NA	HDD
Model	NA	HUS722T2TALA600
Local storage D		
Amount (TB)	NA	1.8
Type	NA	HDD
Model	NA	HUS722T2TALA600
Dimensions		
Height (in.)	18.3	17.0
Width (in.)	6.6	8.6
Depth (in.)	17.5	21.2
Weight (lb.)	32.0	52.0

How we tested

Setting up the workstations

When running the tests, we used a factory-provided image. To prevent software from corrupting the test images, we reset the system's images between tests.

Setting up and updating the OEM image

1. Boot the system.
2. To complete installation, follow the on-screen instructions
    a. Use the default selections when appropriate.
3. Set the Windows Power Plan to Best Performance.
4. Set Screen and Sleep options to Never:
    - Right-click the desktop, and select Display settings.
    - From the left-hand column, select System.
    - Click Power.
    - For all power options listed under Screen and Sleep, select Never.
5. Disable User Account Control notifications:
    - Select Windows Start, type UAC, and press Enter.
    - Move the slider control to Never notify, and click OK.
6. Run Windows Update, and install all updates available.
7. Update the NVIDIA graphics card drivers at https://www.nvidia.com/en-us/drivers/.
8. Launch each vendor proprietary utility app installed on each system, and update any drivers or BIOS files:
9. For Dell, run the Dell Command | Update utility.
10. Download and install the latest NVIDIA drivers from https://www.nvidia.com/en-us/drivers/.
11. Verify the date and time are correct, and synchronize the system clock with the time server.
12. Pause Automatic Windows Updates:
    - Click Windows Start.
    - Type Windows Update settings, and press Enter.
    - From the Pause updates drop-down menu, select Pause for 5 weeks.

Capturing an image

1. Connect an external HDD to the system.
2. Click Windows Menu, and, in the search bar, type Control Panel
3. Click Controkeel Panel→System and Security→Backup and Restore (Windows 7)→Create a system image.
4. Verify that the external HDD is selected as the save drive, and click Next.
5. To back up, verify that all drives are selected, and click Next.
6. Click Start backup.
7. At Do you want to create a system repair disc, select No, and close the dialogs.

Restoring an image

1. Connect an external HDD to the system.
2. Press and hold the Shift key while restarting the system.
3. Select Troubleshoot.
4. Select Advanced options.
5. Select See more recovery options.
6. Select System image recovery.
7. Select the User account.
8. Enter the system password, and click Continue.
9. At the Restore system files and settings screen, select Next.
10. Verify that the external HDD is selected, and click Next.
11. Once the recovery has completed, click Finish.

Booting the system

Before each set of tests, we rebooted the systems and waited for idle processes to complete. After setting up each test, we shut down and booted the system as describe here.

1. Shut down, and boot the system.
2. Select Windows Start.
3. Type cmd, and press Ctrl+Shift+Enter.
4. Type Rundll32.exe advapi32.dll,ProcessIdleTasks.
    a. Do not interact with the system until the command completes.
5. After the command completes, wait 5 minutes before running the test.

Measuring system performance using tools and benchmarks

3DMark benchmark testing

Setting up 3DMark

1. Download the 3DMark benchmark from http://www.futuremark.com/benchmarks/3dmark/all.
2. To install 3DMark with the default options, double-click the 3DMark installer.exe file.
3. To launch 3DMark, double-click the 3DMark desktop icon.
4. Enter the registration code, and click Register.
5. Exit 3DMark.
6. Launch 3DMark again, click Update, and click Install.

Running the test

1. To launch the benchmark, double-click the 3DMark desktop icon.
2. At the 3DMark Home screen, click the benchmark tab.
3. Select Fire Strike Extreme or Time Spy Extreme.
4. To turn off the Include Demo feature, move the slider button.
5. Click Run.
6. When the benchmark run completes, record the results.
7. Wait five minutes.
8. Perform steps 5 through 7 two more times.
9. Report the median result.

Blender benchmark testing

Setting up Blender

1. Download the Blender benchmark from https://opendata.blender.org/.

Running the test

1. Launch the Blender benchmark.
2. At the Welcome screen, click Next.
3. Select Blender version 3.5.0, and click Next.
4. At the Benchmark Scenes screen, choose Monster, The Junk Shop, or Classroom, and click Next.
5. At the Benchmark Device screen, select the GPU option, and click Start Benchmark.
6. Record the results.
7. Wait 15 minutes before performing the next run.
8. Repeat steps 1 through 7 two more times.
9. Report the median result.

Chaos V-Ray benchmark testing

Setting up Chaos V-Ray

1. Download the Chaos V-Ray benchmark from https://www.chaos.com/benchmark-download. We used version 6.00.01.

Running the test

1. Start the Chaos V-Ray benchmark
2. Run V-Ray for CPU for 5 minutes.
3. Record the results.
4. Wait 5 minutes.
5. Repeat steps 1 through 4 two times.
6. Report the median result.

Cinebench 2024 benchmark testing

Setting up Cinebench 2024

1. Download and install Cinebench 2024 from https://www.maxon.net/en/downloads/cinebench-2024-downloads
2. Launch Cinebench 2024.
3. Select File→Advanced benchmark.
4. From the Minimum Test Duration drop-down menu select Off.

Running the test

1. Launch Cinebench 2024.
2. Click File→Run All tests.
3. Record the result.
4. Wait 5 minutes before re-running.
5. Repeat steps 1 through 4 two more times.
6. Report the median result.

Geekbench ML testing

Setting up Geekbench ML

1. Download Geekbench AI from https://www.geekbench.com/ml/
2. Using all defaults, run the installer, and install.

Running the test

1. Launch Geekbnech ML.
2. In Geekbench ML, select ONNX and DirectML
3. For Inference Device, select the GPU.
4. Click Run Inference Benchmark.
5. Wait 5 minutes.
6. Repeat steps 1 through 5 two more times.
7. Record the median result.

Keyshot Benchmark testing

Setting up Keyshot

1. Visit https://www.keyshot.com/viewer/ and complete the form to receive an email with the download link.
2. Using all defaults, download and install Keyshot Viewer.

Running the test

1. Launch Keyshot Viewer
2. Select Benchmark.
3. On the KeyShot Viewer Benchmark, select CPU, and click Run Benchmark.
4. Close the application and wait 15 minutes before performing the next run.
5. Repeat steps 1 through 4 two more times.
6. Report the median result.

Maxon redshiftBenchmark tool testing

Setting up the Maxon redshiftBenchmark tool

1. Download and install the Maxon App from https://www.maxon.net/en/try.
2. Launch the Maxon App.
3. Click the Maxon One 14-day trial, and download and install the RedShift application.

Running the test

1. To open a command prompt, click the Window icon, type cmd, and press Enter.
2. Inside the command prompt, type `cd C:\ProgramData\Redshift\bin`, and press Enter.
3. To start the benchmark, type RunBenchmark.bat, and press Enter.
4. Record the results.
5. Wait 5 minutes.
6. Repeat steps 3 through 5 twp more times.
7. Report the median result.

Metashape Pro photogrammetry and 3D modeling tasks

Setting up Metashape Pro

1. Download and install Metashape Pro from https://www.agisoft.com/downloads/installer/. Use all defaults.

Running the workflow

1. Launch Metashape.
2. From the top menu, select Workflow→Add Photos, select all 148 workload photos, and click Open.
3. Click the Console tab at the bottom of the screen to help monitor the output processes.
4. Click Workflow→Align Photos.
5. Next to the Accuracy drop-down menu, select Highest.
6. Click OK.
7. Let the task finish.
8. To determine the task length, use the console output.
9. Record the time.
10. Click Workflow→Build Point Cloud.
11. Next to the Quality drop-down menu, select Ultra High.
12. Under Advanced, next to the Depth filtering drop-down menu, select Aggressive.
13. Click OK.
14. Let the task finish.
15. To determine the task length, use the console output.
16. Record the time.
17. Click Workflow→Build Model.
18. Next to the Quality drop-down menu, select Ultra High.
19. Under Advanced, next to the Depth filtering drop-down menu, select Aggressive.
20. Click OK.
21. Let the task finish.
22. To determine the task length, use the console output.
23. Record the time.
24. Click Workflow→Build Texture.

25. Leave the default 8,192 texture size, and change the Page count from x1 to x4.
26. Click OK.
27. Let the task finish.
28. To determine the task length, use the console output.
29. Record the time.
30. Save the log file, and close Metashape. Wait 30 minutes before re-running.
31. Repeat steps 1 through 30 two more times.
32. Report the median total time result.

MLPerf ResNet-50 inferencing benchmark testing

Setting up the ResNet-50 workload

Here we set up an mlperf container in Ubuntu 22.04 on WSL2. We use the mlperf container to run a tensorRT supported workload focused on edge systems. This workload targets the GPU exclusively. For more information about this workload, see the following sites:

- https://github.com/mlcommons/ck/blob/master/docs/installation.md
- https://docs.mlcommons.org/inference/benchmarks/image_classification/resnet50/

We performed this section on 06/03/2024, and updated files at that time.

1. On the target system, Enable Microsoft Hyper-V and WSL:

```
Enable-WindowsOptionalFeature -online -featurename Microsoft-Hyper-V-All,VirtualMachinePlatform,Micr
osoft-Windows-Subsystem-Linux -a
```

2. Reboot the system.
3. After rebooting, run updates. At time of writing, this will update to 2.2.4:

```
wsl --update; wsl --update --pre-release
wsl --install Ubuntu-22.04
```

4. Once installed, we entered the following for username and password:

```
# username: ptuser
# password: Password1!
```

5. Use `sudo vim /etc/profile` and add the following to the end of /etc/profile:

```
export PATH="/home/ptuser/.local/bin:$PATH"
```

6. Run updates and exit:

```
sudo apt update -y && sudo apt upgrade -y
exit
```

7. In a new Ubuntu terminal, run the following to install dependencies:

```
sudo apt install python3 python3-pip python3-venv git wget curl zlib1g unzip -y
python3 -m pip install cmind
```

8. Verify cmind functionality by running the following command:

```
cm test core
```

9. Install the required Docker pieces:

```
for pkg in docker.io docker-doc docker-compose docker-compose-v2 podman-docker containerd runc; do
sudo apt-get remove $pkg; done
```

10. Add Docker's official GPG key:

```
sudo apt-get updatez
sudo apt-get install ca-certificates curl
sudo install -m 0755 -d /etc/apt/keyrings
sudo curl -fsSL https://download.docker.com/linux/ubuntu/gpg -o /etc/apt/keyrings/docker.asc
sudo chmod a+r /etc/apt/keyrings/docker.asc
```

11. Add the repository to Apt sources and run updates:

```
echo   "deb [arch=$(dpkg --print-architecture) signed-by=/etc/apt/keyrings/docker.asc] https://
download.docker.com/linux/ubuntu \
$(. /etc/os-release && echo "$VERSION_CODENAME") stable" |   sudo tee /etc/apt/sources.list.d/
docker.list > /dev/null
sudo apt-get update
```

12. Install docker components:

```
sudo apt-get install docker-ce docker-ce-cli containerd.io docker-buildx-plugin docker-compose-
plugin -yVerify docker functionality with sudo.
sudo docker run hello-world
```

13. Configure user and docker group settings:

```
sudo usermod -aG docker $USER
newgrp docker
```

14. Verify docker functionality for user:

```
docker run hello-world
```

15. Enable the docker service.
16. sudo systemctl enable docker.service:

```
sudo systemctl enable containerd.service
```

17. Pull the repository for the mlperf docker container and start the build process. This process takes several hours to complete:

```
cm pull repo gateoverflow@cm4mlops
cm docker script --tags=build,nvidia,inference,server --docker_cache=no --docker_cm_
repo=gateoverflow@cm4mlops
```

Running the test

1. Boot the system and enter the container.
2. Once inside the container, launch the benchmark using;

```
cm run script --tags=run-mlperf,inference,_performance-only,_full  \
   --division=open \
   --category=edge \
   --device=cuda \
   --model=resnet50 \
   --precision=float32 \
   --implementation=nvidia \
   --backend=tensorrt \
   --scenario=Offline \
   --execution_mode=valid \
   --power=no \
   --adr.python.version_min=3.8 \
   --clean \
   --compliance=no \
   --quiet \
   --time \
   --offline_target_qps=13540
```

3. Record the time to complete.
4. From the output directory, save the console.out file.
5. Wait 15 minutes and repeat steps 1 through 4 two more times.
6. Report the median result.

PassMark PerformanceTest 11 benchmark testing

Setting up PerformanceTest 11

1. Download PassMark PerformanceTest from https://www.passmark.com/products/performancetest/download.php.
2. To begin the installation, press Install.
3. To accept the license agreement, select Accept, and press Next.
4. After the installation is complete, deselect Launch Performance Test, and press Finish.

Running the test

1. To launch PassMark PerformanceTest, press the PassMark PerformanceTest icon.
2. To start the benchmark, press Run Benchmark.
3. When the test completes, record the results.
4. Repeat steps 2 through 4 two more times.
5. Report the median result.

Procyon benchmark testing

Setting up Procyon AI Computer Vision Benchmark

1. Purchase and download the Procyon AI Computer Vision Benchmark benchmark from https://benchmarks.ul.com/procyon.
2. Install the Procyon AI computer vision benchmark.
3. Launch Procyon.
4. Select Settings, and input the AI Computer Vision license key.
5. Close Procyon.

Running the test

1. Launch Procyon
2. Select the AI Computer Vision test.
3. Select the Qualcomm SNPE tab.
4. To begin the test, click Run.
5. When the test completes, record the results.
6. Wait 15 minutes.
7. Repeat steps 4 through 6 twice more.
8. Report the median result.

Setting up Procyon office productivity, photo editing, and video editing benchmarks

1. Download and install UL Procyon.
2. Open UL Procyon.
3. Click the benchmark, and click Register.
4. Repeat for all three benchmarks.
5. Enter the license key for each benchmark, and click Register.
6. Before running the benchmarks, install the licensed versions of Microsoft 365, Adobe® Photoshop® 22.0 or higher, Adobe Lightroom® Classic 10.0 or higher, and Adobe Premiere® 14.5 or higher.
7. In the Adobe Creative Cloud desktop application, check for updates.
8. When possible, open all the above applications and disable tips.

Running the tests

1. Launch UL Procyon.
2. Click Office Productivity Benchmark.
3. Click run.
4. When the benchmark is complete, record the results.
5. Click Photo Editing Benchmark.
6. Click Run.
7. When the benchmark is complete, record the results.
8. Click Video Editing Benchmark.
9. Click Run.
10. When the benchmark is complete, record the results.
11. Shut down the system.
12. Repeat steps 1 through 11 twice more.
13. Report the median results.

PugetBench for After Effects benchmark testing

Setting up PugetBench for After Effects

1. Launch Adobe After Effects.
2. Click through the Tutorial pop-up tips.
3. Close Adobe After Effects.
4. Purchase and download the PugetBench for After Effects license from https://www.pugetsystems.com/labs/articles/PugetBench-for-Adobe-Creative-Cloud-1642/.
5. Click Get on Adobe Marketplace, and log into your Adobe account.
6. Click the PugetBench After Effects Plug-in, and install it.
7. Open Adobe After Effects.
8. Click Edit→Preferences→Scripting & Expressions.
9. Select Allow Scripts to Write Files and Access Network, and click OK.
10. Click Edit→Preferences→Memory & Performance.
11. The benchmark requires After Effects to have 12 GB of RAM space. Adjust the RAM reserved for other applications to get to 12 GB RAM reserved for After Effects, and click OK.
12. Click Composition→New Composition.
13. Accept the default Composition Settings, and click OK.
14. Click Composition→Preview, and uncheck Cache Frames When Idle.
15. Click Window→Extensions→PugetBench for After Effects.
16. Next to License Key, click Change, enter your license key, and click Save.

Running the test

1. Open Adobe After Effects.
2. Click Window→Extensions→PugetBench for After Effects.
3. Click Run Benchmark.
4. When the benchmark finishes, record the overall score.
5. Close Adobe After Effect, and restart the system under test.
6. Wait 30 minutes before performing the next run.
7. Repeat steps 1 through 6 two more times.
8. Report the median result.

PugetBench for DaVinci Resolve benchmark testing

Setting up PugetBench for DaVinci resolve

1. Purchase, download, and install DaVinci Resolve 18 Studio from https://www.blackmagicdesign.com/products/davinciresolve. Use all defaults.
2. Launch DaVinci Resolve 18 Studio 18.6.6.
3. When prompted, enter the DaVinci Resolve Studio registration key.
4. Start DaVinci Resolve.
5. If asked to Update, download and install the Update.
6. During the setup, click skip the initial setup.
7. Once launched, when asked to Optimize the Neural Engines for NVIDIA GPUs, click Optimize.
8. To confirm the Resolve configuration options, Click New Project.
9. Click DaVinci Resolve Preferences.
10. In the Memory and GPU tab, ensure the GPU processing mode is set to Auto, and that Use neural engine optimization on NVIDIA is checked.
11. Close DaVinci Resolve Studio.
12. Purchase a PugetBench for DaVinci Resolve license from https://www.pugetsystems.com/labs/articles/pugetbench-fordavinci-resolve-1523/.
13. Download PugetBench for DaVinci Resolve.
14. When the download completes, unzip the benchmark.

Running the test

1. From the extracted benchmark folder, extract the Run PugetBench for DaVinci Resolve program.
2. Click Run Benchmark.
3. When the benchmark finishes, record the overall score.
4. Wait 30 minutes before performing the next run.
5. Repeat steps 1 through 4 twice more.
6. Report the median result

PugetBench for Premier Pro benchmark testing

Setting up PugetBench for Premier Pro

1. Install Adobe Creative Cloud from https://creativecloud.adobe.com/apps/download/creative-cloud?locale=en
2. In Creative Cloud, search and Install Premier Pro.
3. Launch Adobe Premiere Pro.
4. Click through the Tutorial pop-up tips.
5. Close Adobe Premiere Pro.
6. Purchase a PugetBench for Premiere Pro license from https://www.pugetsystems.com/labs/articles/PugetBench-for-AdobeCreative-Cloud-1642/.
7. Download PugetBench for Creators from https://www.pugetsystems.com/pugetbench/creators/#h-download-pugetbench-for-creators.
8. Enter the license key.
9. Click Download Assets, and wait for the process to complete.
10. Shut down the system.

Running the test

1. Open Adobe Premiere Pro.
2. In Downloads→PugetBench for Premiere Pro, open the Benchmark_Project_23.prproj file.
3. Click Window→Extensions→PugetBench for Premiere Pro.
4. Click Run Benchmark.
5. When the benchmark finishes, record the overall score.
6. Close Adobe Premiere Pro, and restart the system under test.
7. Wait 30 minutes before performing the next run.
8. Repeat steps 1 through 7 twice more.
9. Report the median result.

Revit 2024.1 RFO benchmark testing

Setting up Revit 2024.1 RFO

1. Download and install Revit 2024 from https://www.autodesk.com/products/revit/free-trial.
2. Launch Revit 2024, and sign in with the account information.
3. At the Tutorial screen, click Don't show this again.
4. Close Revit 2024.
5. Download the Revit 2024 RFO Benchmark Tool from https://www.revitforum.org/forum/revit-all-flavors/hardware-andinfrastructure/36875-rfo-benchmark-v3.
6. Extract the Revit 2024 RFO Benchmark Tool.

Running the test

1. Open the Extracted Revit 2024 RFO benchmark tool directory.
2. To launch the benchmark, click _RFO Benchmark – Full_Standard shortcut.
3. When the benchmark finishes, record the results.
4. Wait 15 minutes.
5. Repeat step 1 through 4 two more times.
6. Report the median result.

SPECapc for Creo 9 benchmark testing

Setting up SPECapc for Creo 9

1. Purchase a license for Creo 9.
2. Using the Welcome email, log in to your PTC account, and designate a site administrator.
3. Download the Win64 Creo 9.0 installer from here https://support.ptc.com/appserver/auth/it/esd/product.jsp?prodFamily=ENG. From PTC Sofware Downloads, PTC lists the file under Parametric, Release Creo 9.0, Creo 9.0 for Windows. We download Creo 9.0.7.0.
4. On a separate Windows system, run install_license_server.exe.
5. In the Creo Installation Assistant – Creo 9.0.8.0 Window, select Install License Server, and click Next.
6. Accept the Software License Agreement, and click Next.
7. On the License Identification screen, select Simple license entry, and click Next.
8. For License Generation for Server Install, select Simple License entry.
9. Enter the sales order number located on your purchase order, and click Install License.
10. To log in to PTC.com, use your credentials.
11. Click Finish.
12. To verify that the license server is running, browse to the server IP and port 8090 or [server_ip]:8090.
13. Log in with the default credentials, admin/admin, enter a new Password, and verify that the license server is running with available licenses.
14. On, the system under test, copy the Creo Installation folder above to the target system.
15. Run Setup.exe.
16. At the Introduction screen, click Next.
17. At the Software License Agreement screen, accept the agreement and export agreement, and click Next.
18. Add the license server using 7080@[ip_of_license server], select the License server, and click Next.
19. At the Application Selection screen, accept the Defaults, and click Next.
20. At the Customize Application screen, confirm that Creo Render Studio is selected, and click Install.

21. Once the installation completes, click Finish.
22. Launch Creo Parametric, and close any prompts.
23. Download SPECapc for Creo 9 from https://gwpg.spec.org/benchmarks/benchmark/specapc-ptc-creo-9/.
24. Using all default options, extract and complete the installation.

Running the test

1. Open SPECapc for Creo 9
2. Set the iterations to 3.
3. Click Start test. After it completes, report the median results.

SPECapc for Maya 2024 benchmark testing

Setting up SPECapc for Maya 2024

1. Purchase and install a full license of Maya 2024 from https://www.autodesk.com/products/maya/overview?term=1-YEAR&tab=subscription.
2. Go to https://gwpg.spec.org/benchmarks/benchmark/specapc-maya-2024/ and purchase and download the vendor license of the benchmark.
3. Unzip the SPECapc Maya.zip file to C:\.
4. Navigate to the extracted SPECapc Maya 2024 directory.
5. To extract installation files, click SPECapcMaya2024-1.01.exe.
6. To install the benchmark, click SPECapc_Maya2024_combined.exe.
7. Set the DPI scaling to 100 percent:
    - Right-click on the desktop and select Display settings.
    - From the Scale drop-down menu, select 100%.

Running the test

1. To launch the SPECapc Maya benchmark, click the desktop icon.
2. Click Run Benchmark.
3. When the test is complete, record the results.
4. Repeat steps 1 through 3 two more times.
5. Report the median result.

SPECapc for SolidWorks 2024 benchmark testing

Setting up SPECapc for Solidworks 2024

1. Purchase a Solidworks license.
2. Note your Premium and Visualize serial numbers from the purchase confirmation pdf.
3. Download Solidworks 2024 SP3.1 from Solidworks's website.
4. Unzip and run the installer.
5. When prompted enter the serial numbers for Premium and Visualize. When prompted accept the EULA.
6. When prompted, reboot the system.
7. Open Solidworks 2024 and click I want to activate my SOLIDWORKS product now, and click Next.
8. Leave Activate Automatically over the Internet selected, enter an email address, and click Next.
9. Open Solidworks Visualize 2024.
10. Enter your email and click Next.
11. When prompted, accept the License Agreement.
12. Download SPECapc for Slidworks from https://gwpg.spec.org/benchmarks/benchmark/specapc-solidworks-2024/.
13. Install SPECapc for Solidworks 2024 version 1.13 using all defaults.

Running the test

1. Open the SPECapc for Solidworks 2024 v1.13 Benchmark.
2. To set iterations, change the counter to 3.
3. Check the box to enable Anti-aliasing: FSAA.
4. Click Run.
5. Record the median results.

SPECviewperf 2020 v3.1 benchmark testing

Setting up SPECviewperf 2020 v3.1

1. Navigate to https://gwpg.spec.org/benchmarks/benchmark/specviewperf-2020-v3-1/, and purchase and download the vendor license of the benchmark.
2. Download and unzip SPECviewperf® 2020 v3.1.
3. Navigate to the extracted SPECviewperf® 2020 v3.1 directory.
4. To install, click the .exe file.
5. Under Windows Settings, System, Display, Scale & layout, set Scale to 100.

Running the FHD and 4K tests

1. Launch SPECviewperf.
2. Change the iterations to 1.
3. Set the resolution to either 1,920 x 1,080 (FHD) or 3,280 x 2,160 (4K)..
4. Click Run.
5. When the test is complete, record the results.
6. Repeat steps 1 though 5 twice more.
7. Report the median result.

SPECworkstation 3.1 benchmark testing

Setting up SPECworkstation 3.1

1. Go to https://www.spec.org/gwpg/wpc.static/workstation3-info.html and purchase and download the vendor license of the benchmark.
2. Unzip the SPECworkstation_304.zip file to C:\.
3. Navigate to the extracted SPECworkstation_304 directory.
4. To install, click SPECworkstation_304.exe .

Running the test

1. Launch SPECworkstation.
2. Change the iterations to 3, and check the box next to Official Run.
3. Click the OpenCL/CUDA Configuration button, select the discrete graphics card option, and select CUDA.
4. Click Run Benchmark.
5. When the test is complete, record the results
6. Repeat steps 1 through 5 two more times.
7. Report the median result.

Unreal Engine project compilation

Setting up the project compilation

1. Download the Epic Games Launcher from https://www.unrealengine.com/en-US/download
2. In the Launcher, install Unreal Engine. We installed 5.4.2
3. Open Unreal Engine.
4. To associate Unreal Engine project files with Unreal Engine, when asked, click Fix Now.

Downloading the Lyra starter game

Complete the following steps for the Lyra Starter Game.

1. In the Epic Game Launcher, click the Samples Tab.
2. Click Lyra Starter Game.
3. Click Create Project, then Create. Note the listed file location.
4. Launch Unreal Engine.
5. Browse to the Lyra Starter Game file location, open the project, and continue from Running the Test.

Running the test

We completed the above steps with the following pre-built projects.

- Downloaded – LyraStarterGame
- Architecture – Archvis
- Fill / Video & Life Events - DMX

1. Select Unreal Engine, and click Launch.
2. In the Project Selection screen, select the project under test, and click Open.
3. In Unreal Engine, under Platforms, select Windows, choose Shipping, and choose Package Content.
4. At the project root, create a new folder, left-click that Folder, and click Select Folder.
5. Click Output log, and record the BuildCookRun time.
6. Wait 10 minutes.
7. Repeat steps 1 through 5 two more times.
8. Report the median result.

Measuring multitasking capabilities

Autodesk Revit modeling and Autodesk Maya rendering multitasking scenario

Installing Autodesk Revit and Autodesk Maya.

1. Sign up for and download custom install Autodesk Revit 2024 from autodesk.com/products/revit/free-trial.
2. Complete the Revit 2024 instlallation using all defaults.
3. After the installation is complete, click Launch Now.
4. Purchase a license and install Maya 2024 using all defaults from
5. After the installation is complete, click Launch Now.

Setting up the Revit model

1. Download the rst_advanced_sample_project.rvt file from Autodesk's website at https://help.autodesk.com/view/RVT/2024/ENU/?guid=GUID-61EF2F22-3A1F-4317-B925-1E85F138BE88.
2. Open Revit 2024.
3. Open the sample file.
4. Select File→Export→FBX. This should export as racadvancedsampleproject – 3D View from Parking Area. Note, when completing this task on both systems, verify that both exported RXF files are the same size.
5. On the View tab, click Render.
6. In the Rendering Window, set the following parameters, leaving all others as default.
   - Quality: High
   - Output Settings
     - Resolution: Printer, 150 DPI
   - Lighting
     - Scheme: Exterior: Sun and Artificial
     - Setting up the Revit test

Setting up the Maya render

1. Open Maya 2024.
2. Open the exported RXF file.
3. Change to the Rendering – Standard workspace.
4. In the right hand pane, under Render Settings, for Render Using, select Maya Hardware 2.0.
5. Under the Common tab, set the following parameters, leaving all others as default:
    - Image format: PNG
    - Frame Range
        - Start frame: 0
        - End frame: 175.0
        - By frame: 1.0
    - Renderable Camera: FBXA…View…From…Parking…Area
    - Image Size:
        - Presets: 4k Square
6. Click File, Save As, and Save the workplace settings.

Running the Revit model

1. Open and configure the Revit Render as described above. Skip step 6.
2. In the Rendering Windows, click Render.
3. In the Rendering Progress Window, deselect "Close dialog when rendering is complete"
4. Record the Elapsed time.
5. Wait 5 minutes and repeat steps 2 through 4 twice more.
6. Close Revit 2024.
7. Report the median result.

Running the Maya render

1. Open Maya 2024, and open the saved workplace file from Step 6 above.
2. Verify all Render Settings are correct, and click the Rendering tab.
3. Under the Render Menu, click Batch Render.
4. Wait for the batch render to complete.
5. Open the MayaRenderLog file and record the Render time. By default the file is located at [user root]\Documents\maya
6. Wait 5 minutes and repeat steps 2 through 4 twice more.
7. Close Maya 2024.
8. Report the median results.

Testing multitasking with both Revit and Maya

1. Open and configure the Revit Render as described above. Skip step 6.
2. Open Maya and the saved workplace file from step 6 above.
3. In Maya and under the Render Menu, click Batch Render
4. Immediately, switch to the Revit Render Window, and click Render.
5. In the Rendering Progress Window, deselect Close dialog when rendering is complete.
6. For Revit, record the Elapsed time.
7. For Maya, from the MayaRenderLog file, record the Render time.
8. Wait 15 minutes.
9. Repeat steps 3 through 7 two more times.
10. Report the median results.

Measuring Acoustics

Measuring acoustics while running Cinebench 2024

These tests require the following items:

- Extech SDL600 Sound Level Meter/Datalogger with SD card
- Cinebench 2024

Setting up the test

1. Place the system under test in a sound-proofed professional sound booth.
2. Set the Extech SDL600 on a tripod so that it is 2 feet in front of, and 1 foot above the bottom of the system under test.
3. Download and install Cinebench 2024 from https://www.maxon.net/en/downloads/cinebench-2024-downloads.
4. Launch Cinebench 2024.
5. Select File→Advanced benchmark.
6. Select File→Preferences, and change the Custom Minimum Test Duration to 90 minutes, and click OK.
7. Exit Cinebench and shutdown the system.

Running the test

1. Boot the system.
2. Launch Cinebench 2024.
3. In the Minimum Test Duration field, select Custom (90 minutes).
4. Start the Extech SDL600 Sound Level Meter/Datalogger, and record 5 minutes of system idle activity.
5. Click the Cinebench 2024 CPU (multi-core) Start button.
6. At the end of the 90-minute Cinebench 2024 run, stop the Extech SDL600, and record the average sound level (dB) while running Cinebench 2024, during the last 30 minutes of the test.
7. Shut down the system for 90 minutes, and let it return to room temperature.
8. Repeat steps 1 through 7 two more times. Report the median results.

Measuring Thermals

Measuring thermals while running Cinebench 2024

These tests require the following:

- A FLIR E6-XT Infrared Camera
- Thermal data logger with 6 thermal probes
- Cinebench 2024

We recorded temperatures for the following locations for a 5 minute idle period followed by a 90 minute sustained Cinebench 2024 run:

- Ambient temperature
- Chassis top – The top of the chassis, as close to the front as possible.
- Chassis front – The center of the chassis, the hottest point on the center of the chassis while avoiding any vents.
- Rear fan CPU exhaust – The exhaust fan directly behind the CPU.
- PSU skin temperature – The power supply unit (PSU) temperature under the plug. This does not interrupt any airflow.

Running the test

1. Start the thermal recorder.
2. Boot the system.
3. Launch Cinebench 2024.
4. Select File→Advanced benchmark.
5. Verify that the Custom Test setting is set to 90 minutes.
6. Select CPU (Multi Core) and click Start.
7. Record the performance results after 90 minutes. Record the at the end of each run, note the ambient room temperature.
8. Report the median temperatures from three runs using the average temperature of each location during the last 30 minutes of the 90 minute test period.

Read the report at https://facts.pt/mCY7hpX ▶

This project was commissioned by AMD and HP.

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