Boost productivity with an HP ZBook Power G11 A Mobile Workstation PC

We compared system responsiveness and battery life on an AMD Ryzen 9 PRO 8945HS processor-powered HP ZBook Power G11 A Mobile Workstation PC to Intel Core Ultra 9 185H processor-based Dell Precision and Lenovo ThinkPad mobile workstations

Neural processing units (NPUs) have been improving camera performance in smartphones for years—but AMD® and Intel® have only recently added NPUs to the central processing unit (CPU) and graphics processing unit (GPU) architecture built into many HP, Dell™, and Lenovo® AI laptops and mobile workstations.[1,2,3] While many mobile workstations still rely on integrated GPUs to handle the bulk of AI workstation tasks, workstation apps that run on the NPU are in development.

These NPUs can do much more than improve camera performance. In a world powered by AI, they're designed to accelerate workflows and improve power efficiency.[4] But which mobile workstation and processor combo is best for on-the-go professionals now and in the future?

To find out, we used industry-standard benchmarks to compare performance in general and processor-intensive scenarios, measured battery life and power efficiency, and recorded noise levels under load on three 16-inch mobile workstations:

- **HP ZBook Power G11 A Mobile Workstation PC**
  powered by an AMD Ryzen™ 9 PRO 8945HS processor
- **Dell Precision® 3591 Mobile Workstation**
  powered by Intel vPro® with Intel Core™ Ultra 9 processor 185H
- **Lenovo ThinkPad® P16v Gen 2 Mobile Workstation**
  powered by Intel vPro with Intel Core Ultra 9 processor 185H

Read on to learn more about what we found.

Build better products faster

Up to 14.6% higher SPECapc® for Creo 9 score

Get insights faster with neural networks

Up to 77.2% higher Geekbench AI Half Precision score

Work unplugged without worry

Up to 13 hr and 21 min of battery life*

This project was commissioned by HP and AMD.

*UL Procyon™ Battery Life Benchmark results in Windows 11 Best power efficiency power mode.

How we tested

We focused our testing on processor capabilities and battery life—but we recognize that random access memory (RAM) and storage also pay important roles in the overarching performance picture. To make sure we had more than enough RAM and storage to run our tests, we equipped each 16-inch Windows 11 Pro test system with 64 GB of DDR5-5600 RAM and 1 TB of PCIe® Gen4 NVMe™ storage. We also configured each test system with discrete NVIDIA® graphics cards, with the HP and Lenovo systems using NVIDIA RTX™ 3000 Ada generation graphics and the Dell system using NVIDIA RTX 2000 Ada generation graphics (the closest match available for the Dell system at the time of testing).

HP ZBook Power G11 A Mobile Workstation PC

- 8-core and 16-thread AMD Ryzen 9 PRO 8945HS processor
- Integrated AMD Radeon™ 780M Graphics
- Integrated Ryzen AI NPU
- Discrete NVIDIA RTX 3000 Ada generation graphics
- 83-WHr battery

Dell Precision 3591 Mobile Workstation

- 16-core and 22-thread Intel vPro with Intel Core Ultra 9 processor 185H
- Integrated Intel Arc™ Graphics
- Integrated Intel AI Boost NPU
- Discrete NVIDIA RTX 2000 Ada generation graphics
- 97-WHr battery

Lenovo ThinkPad P16v Gen 2 Mobile Workstation

- 16-core and 22-thread Intel vPro with Intel Core Ultra 9 processor 185H
- Integrated Intel Arc Graphics
- Integrated Intel AI Boost NPU
- Discrete NVIDIA RTX 3000 Ada generation graphics
- 90-WHr battery

First, we evaluated the 16-inch mobile workstations' performance using these general productivity, content creation, and AI benchmarking tools:

- Blender Benchmark
- Geekbench AI
- LM Studio
- PassMark PerformanceTest 11
- SPECapc® for Creo 9
- SPECworkstation® 3.1

Then, we ran the MobileMark 30 and UL Procyon Battery Life benchmarks in the Windows 11 Best power efficiency power mode. We also measured battery life during a Microsoft Teams video meeting with nine participants in the Windows 11 Best power efficiency power mode.

To determine how much noise the mobile workstations emitted while running a sustained, processor-intensive load, we measured acoustics while they were plugged in and running the Cinebench 2024 benchmark for 90 minutes.

The results we report reflect the specific configurations we tested. Any difference in the configurations—as well as screen brightness, network traffic, and software additions—can affect these results. For a deeper dive into our testing parameters and procedures, see the science behind the report.

About the HP ZBook Power G11 A Mobile Workstation PC

The ISV-certified 16-inch HP ZBook Power G11 A Mobile Workstation PC includes up to an AMD Ryzen 9 PRO 8945HS CPU, integrated AMD Radeon Graphics, up to 64 GB of SODMM DDR5 memory, up to 2 TB of PCIe NVMe SSD storage, and optional NVIDIA RTX graphics.[5] Additional benefits of HP ZBook mobile workstations include:

Durability and reliability: Per HP, to ensure durability, each system goes through the HP System Validation Test Protocol, which includes yanking out cables, subjecting screens to abrasion tests, and opening and closing the clamshell tens of thousands of times. All HP ZBook mobile workstations must also survive military-grade durability tests (i.e., drop, vibration, explosive atmosphere, dust, and humidity). Current-gen HP ZBook mobile Workstation PCs have undergone over 120,000 hours of testing and validation to make sure they are "hardened and designed for ultimate reliability."[6]

Privacy and security: HP enables professionals to protect onscreen data from prying eyes with HP Sure View, which increases privacy though a proprietary backlight and light control film.[7] Organizations and users can also strengthen security with HP Sure Click, which traps and deletes malware.[8]

General performance

Whether you're running demanding applications, multitasking, or editing marketing materials, a system with faster and more powerful computing capabilities can improve your experience and might even boost productivity. We evaluated the workstations' general performance using the PassMark PerformanceTest 11 and SPECworkstation 3.1 benchmarks.

PassMark PerformanceTest 11 combines CPU, 2D and 3D graphics, storage, and memory test performance metrics into an overall PassMark rating.[9]

PassMark PerformanceTest 11.0 overall ratings
(higher is better)

HP ZBook Power G11 A — 10,694
Dell Precision 3591 — 9,043
Lenovo ThinkPad P16v Gen 2 — 10,767
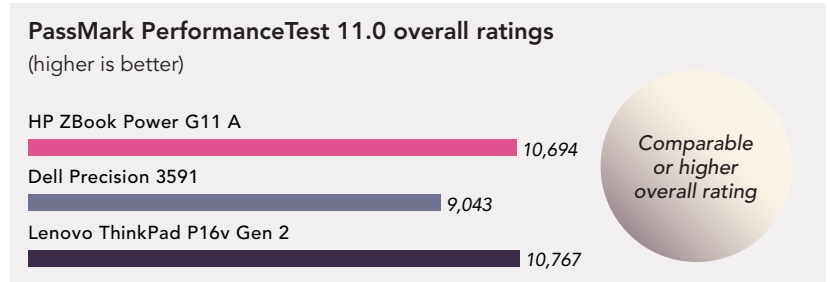
Comparable or higher overall rating

Figure 1: PassMark PerformanceTest 11.0 overall ratings. Higher is better. Source: Principled Technologies.

SPECworkstation 3.1 measures CPU, graphics, I/O, and memory bandwidth in media and entertainment workloads (e.g., 3D animation, video encoding, and rendering) as well as financial services workloads (e.g., probability simulation and pricing models).[10]

SPECworkstation 3.1 overall scores (higher is better)

Media and Entertainment

HP ZBook Power G11 A — 3.27
Dell Precision 3591 — 3.13
Lenovo ThinkPad P16v Gen 2 — 3.32

Comparable or higher Media and Entertainment overall score

Financial Services

HP ZBook Power G11 A — 3.79
Dell Precision 3591 — 3.07
Lenovo ThinkPad P16v Gen 2 — 3.29

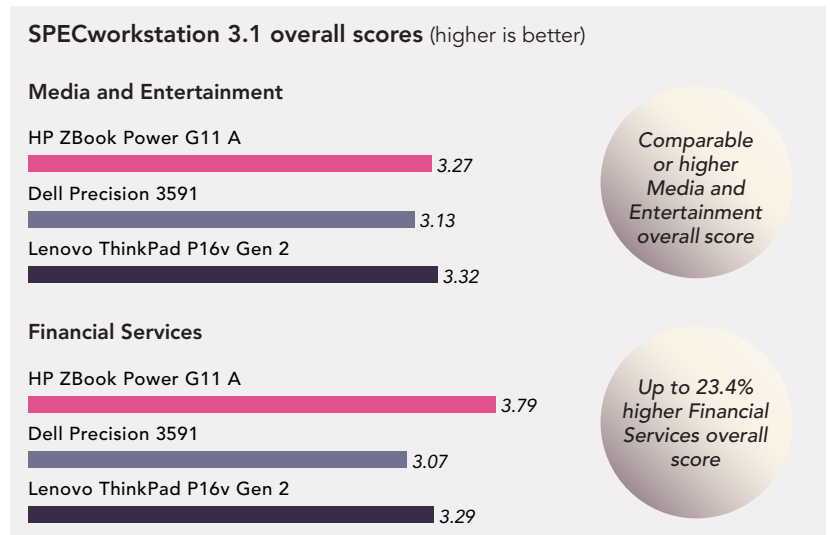Up to 23.4% higher Financial Services overall score

Figure 2: SPECworkstation 3.1 overall scores. Higher is better. Source: Principled Technologies.

Note: The graphs in this report use different scales to keep a consistent size. Please be mindful of each graph's data range as you compare.

Resource-intensive application performance

While the test results in the previous section provided a general performance overview, business, creative, and technical professionals stress their mobile workstations with a variety of design, media, and data analysis workloads. A system with faster and more powerful computing capabilities can speed content creation and boost AI performance.

3D rendering performance

In our tests, the AMD Ryzen 9 PRO 8945HS processor-powered HP ZBook Power G11 A Mobile Workstation PC received comparable or higher 3D rendering performance scores than the Intel vPro with Intel Core Ultra 9 processor 185H-based mobile workstations we tested. Higher scores here could help product designers, videographers, and other 3D artists get projects out the door faster.

Blender Benchmark measures how quickly the Cycles production render engine can render path-tracing samples on the CPU of each mobile workstation.[11]

Blender Benchmark workload scores (higher is better)

Classroom

HP ZBook Power G11 A — 49.66

Dell Precision 3591 — 40.35

Lenovo ThinkPad P16v Gen 2 — 49.58

Comparable or higher Classroom score

Junk Shop

HP ZBook Power G11 A — 69.71

Dell Precision 3591 — 62.51

Lenovo ThinkPad P16v Gen 2 — 70.14

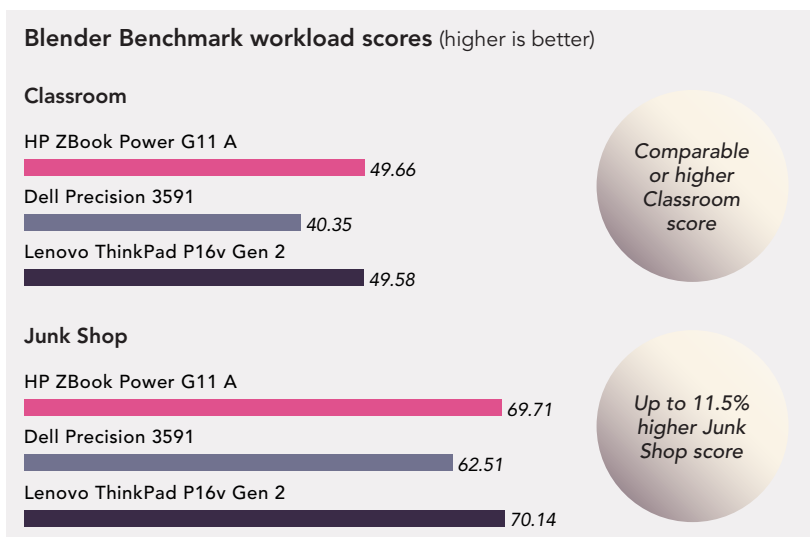*Up to 11.5% higher Junk Shop score*

Figure 3: Blender 4.2 CPU workload scores. Higher is better. Source: Principled Technologies.

About the AMD Ryzen 9 PRO 8945HS processor

The AMD Ryzen 9 PRO 8945HS processor is a Zen 4 AMD Ryzen processor engineered for premium laptops. The 8-core, 16-thread AMD Ryzen 9 PRO 8945HS processor has integrated AMD Radeon 780M graphics and Ryzen AI capabilities with up to 16 trillions of operations (TOPs) of NPU performance. Clock speeds are between 4 and 5.2 GHz.[12] The AMD Ryzen 9 PRO 8945HS processor also includes a suite of dedicated technologies for business, creative, and technical professionals:

PRO graphics: AMD Radeon PRO GPUs are designed to improve 3D modeling and design experiences.

PRO security: AMD Shadow Stack and AMD Memory Guard multi-layered security features protect sensitive data.

PRO manageability: Cloud-based Windows Autopilot and Microsoft Endpoint Manager help simplify PC deployment and management.[13]

You can learn more about AMD Ryzen AI processors at: https://www.amd.com/en/products/processors/business-systems/ryzen-ai.html.

CAD design performance

The **SPECapc for Creo 9** benchmark taxes all aspects of system performance and generates composite scores for both CPU and GPU.[14] We found that the AMD Ryzen 9 PRO 8945HS processor-powered HP ZBook Power G11 A Mobile Workstation PC received higher CPU and GPU composite scores than the Intel vPro with Intel Core Ultra 9 processor 185H-based mobile workstations we tested. Higher scores here could help engineers, manufacturers, and design firms build better products faster.
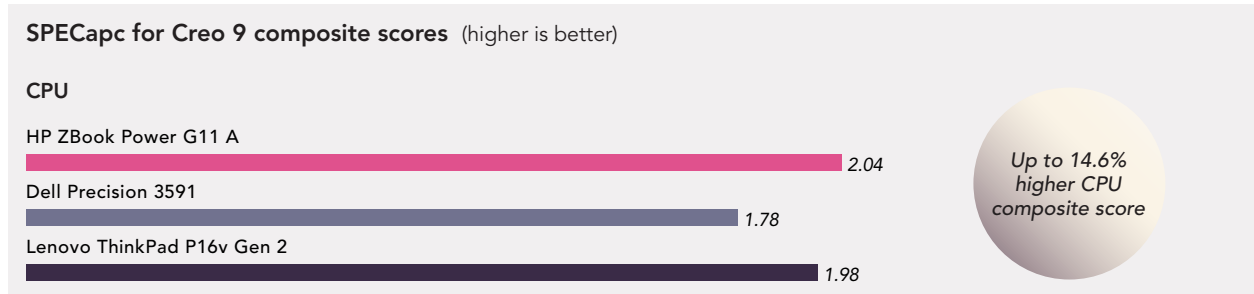
SPECapc for Creo 9 composite scores (higher is better)

CPU

HP ZBook Power G11 A
2.04

Dell Precision 3591
1.78

Lenovo ThinkPad P16v Gen 2
1.98

Up to 14.6% higher CPU composite score

Figure 4: SPECapc for Creo 9 benchmark scores. Higher is better. Source: Principled Technologies.

AI/ML workflow performance

Geekbench AI evaluates different levels of real-world AI performance.[15] In our testing, we used the Open Neural Network Exchange (ONNX) AI framework and DirectML AI backend for machine learning on Windows. **Single Precision scores** are relevant for medicine and deep learning uses cases, where higher levels of precision are necessary for hyper-accurate image analysis and object classification. **Half Precision scores** are more relevant for data scientists working with small datasets or models, which prioritize faster data processing over hyper-accuracy.
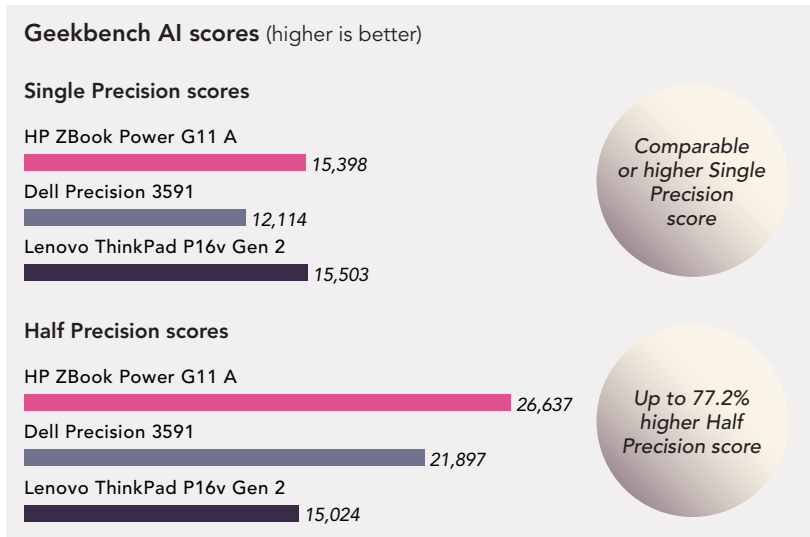
Geekbench AI scores (higher is better)

Single Precision scores

HP ZBook Power G11 A
15,398

Dell Precision 3591
12,114

Lenovo ThinkPad P16v Gen 2
15,503

Comparable or higher Single Precision score

Half Precision scores

HP ZBook Power G11 A
26,637

Dell Precision 3591
21,897

Lenovo ThinkPad P16v Gen 2
15,024

Up to 77.2% higher Half Precision score

Figure 5: Geekbench AI ONNX DirectML inference scores. Higher is better. Source: Principled Technologies.

LM Studio uses large language models (LLMs) to evaluate AI chat capabilities.[16] In our testing, we used the Meta-Llama-3.1-8B-Instruct-Q4_K_M model to capture token metrics—where tokens are words, subwords, or characters. The LLM's job is to predict the most likely token to follow a sequence of input tokens and generate valuable output.[17] The more tokens per second a mobile workstation can process, the richer the context for content creation, language translation, sentiment analysis, and question answering.
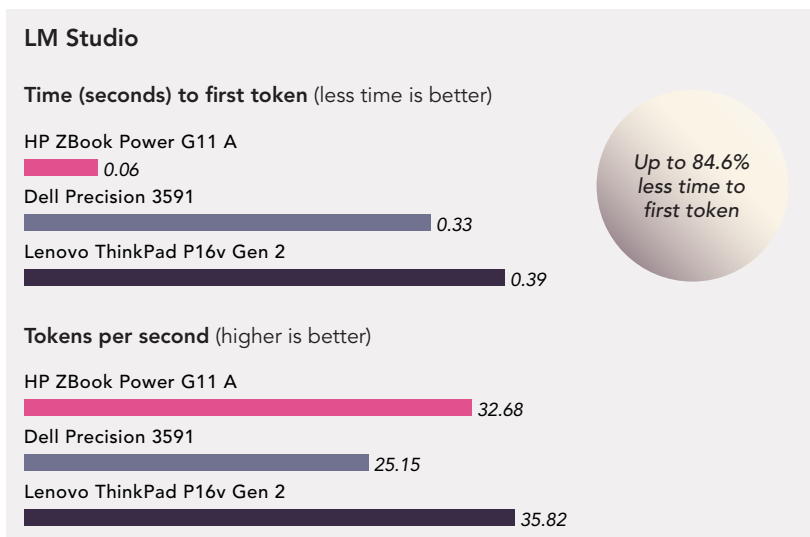
LM Studio

Time (seconds) to first token (less time is better)

HP ZBook Power G11 A
0.06

Dell Precision 3591
0.33

Lenovo ThinkPad P16v Gen 2
0.39

Up to 84.6% less time to first token

Tokens per second (higher is better)

HP ZBook Power G11 A
32.68

Dell Precision 3591
25.15

Lenovo ThinkPad P16v Gen 2
35.82

Figure 6: LM Studio results. Less time and more tokens are better. Source: Principled Technologies.

Battery life and power efficiency

For a general battery life and system efficiency (minutes per WHr) assessment in Windows 11 Best power efficiency mode, we ran the Procyon Battery Life Benchmark and MobileMark 30 battery life benchmark in Windows 11 Best power efficiency power mode. We also measured unplugged battery life while conducting a Microsoft Teams video meeting with nine participants in Windows 11 Best power efficiency power mode. Higher minutes per WHr reflect better power efficiency. It's worth noting that the HP ZBook Power G11 A Mobile Workstation PC contained an 83-WHr battery, which is a much smaller capacity than the batteries in either the Dell Precision 3591 (97-WHr) or Lenovo ThinkPad P14v Gen 2 (90-WHr) mobile workstations.
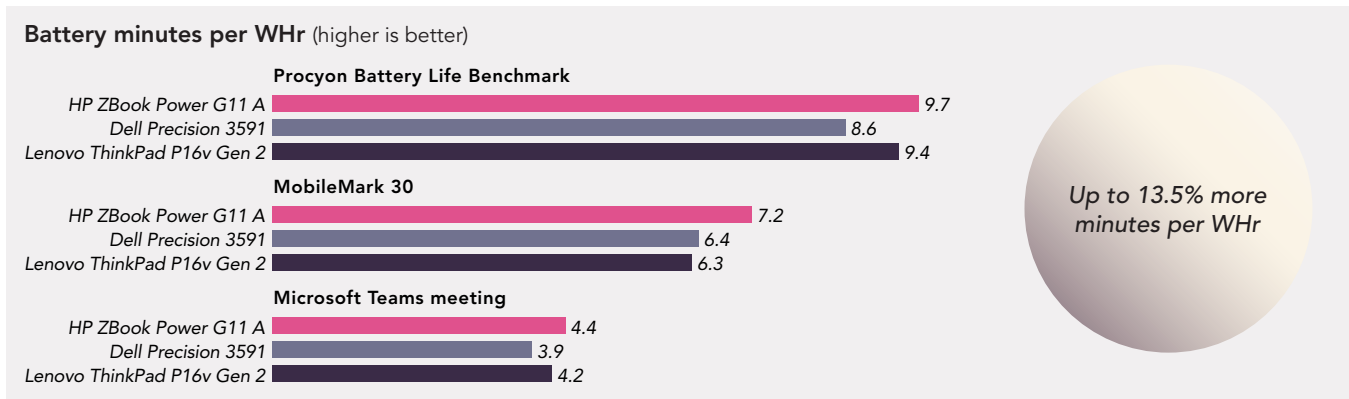
Battery minutes per WHr (higher is better)

Procyon Battery Life Benchmark

HP ZBook Power G11 A	9.7
Dell Precision 3591	8.6
Lenovo ThinkPad P16v Gen 2	9.4

MobileMark 30

HP ZBook Power G11 A	7.2
Dell Precision 3591	6.4
Lenovo ThinkPad P16v Gen 2	6.3

Microsoft Teams meeting

HP ZBook Power G11 A	4.4
Dell Precision 3591	3.9
Lenovo ThinkPad P16v Gen 2	4.2

Up to 13.5% more minutes per WHr

Figure 7: Battery life benchmark minutes per WHr results. Higher is better. Source: Principled Technologies.

Battery life (h:mm, higher is better)

Procyon Battery Life Benchmark

HP ZBook Power G11 A	13:21
Dell Precision 3591	13:55
Lenovo ThinkPad P16v Gen 2	14:02

MobileMark 30

HP ZBook Power G11 A	9:56
Dell Precision 3591	10:16
Lenovo ThinkPad P16v Gen 2	9:29

Microsoft Teams meeting

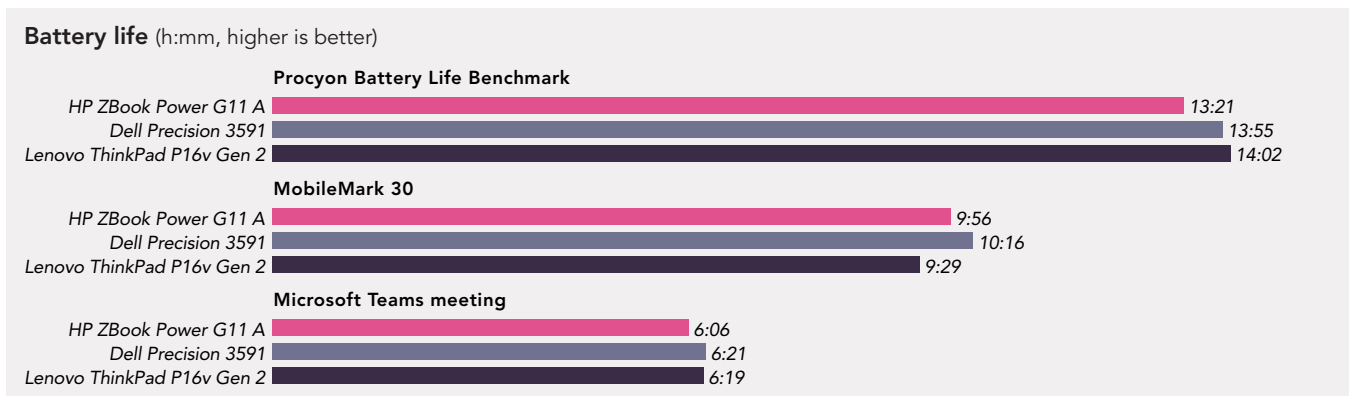|	
HP ZBook Power G11 A	6:06
Dell Precision 3591	6:21
Lenovo ThinkPad P16v Gen 2	6:19

Figure 8: Battery life benchmark results in Windows 11 Best power efficiency power mode. More time is better.

Noise levels under load

Some workstations can be very loud, especially when they're running resource-intensive applications. The ambient room noise before we started testing was 23.2 decibels (dBA). We plugged in the HP, Dell, and Lenovo mobile workstations and ran the Cinebench 2024 benchmark for 90 minutes. During the last 30 minutes of testing, we measured acoustics while the systems were under load. For reference, 10dBA is equivalent to normal breathing, 30dBA is whispering, and 40dBA is what you'd hear in a quiet office or residential area.[18] In our tests, the AMD Ryzen 9 PRO 8845HS processor-powered HP ZBook Power G11 A was quieter under load than the Intel vPro with Intel Core Ultra 9 processor 185H-powered Dell Precision 3591 and Lenovo ThinkPad P14v Gen 2 mobile workstations—and it was not at the expense of performance.

Cinebench 2024 performance scores (higher is better)

HP ZBook Power G11 A
923

Dell Precision 3591
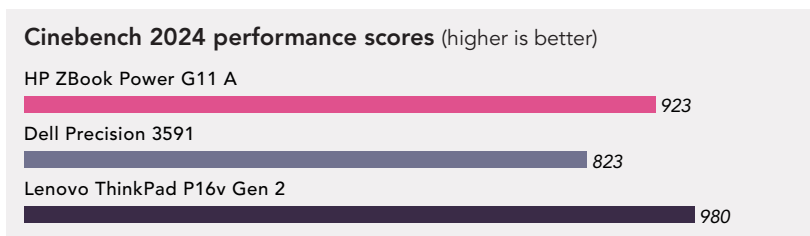*823*

Lenovo ThinkPad P16v Gen 2
980

Figure 9: Performance scores while the PCs were plugged in and running the Cinebench 2024 benchmark for 30 minutes. Higher performance scores are better.
Source: Principled Technologies.

Average dBA (lower is better)

HP ZBook Power G11 A
24.0

Dell Precision 3591
34.2

Lenovo ThinkPad P16v Gen 2
39.7

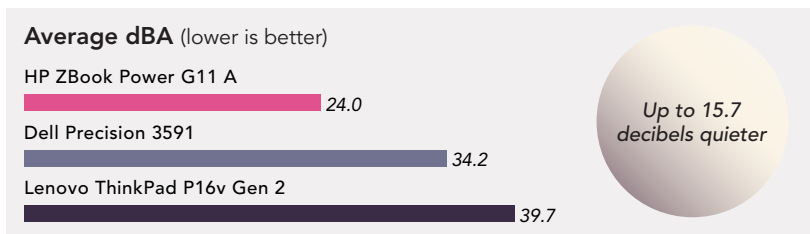*Up to 15.7 decibels quieter*

Figure 10: Average decibels recorded while the PCs were plugged in and running the Cinebench 2024 benchmark for 30 minutes. Lower decibels are better. Source: Principled Technologies.

Conclusion

Strong CPU, GPU, and NPU performance can help speed workflows and improve system efficiency for on-the-go professionals. In our hands-on tests, we found that the AMD Ryzen 9 PRO 8845HS processor-powered HP ZBook Power G11 A Mobile Workstation PC received comparable or higher general productivity, content creation, and AI benchmark scores than the Intel vPro with Intel Core Ultra 9 processor 185H-powered Dell Precision 3591 and Lenovo ThinkPad P16v Gen 2 mobile workstations. As an added bonus, the AMD Ryzen 9 PRO 8945HS processor-powered HP ZBook Power G11 A Mobile Workstation PC also delivered all-business-day battery life.

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Read the science behind this report at https://facts.pt/L37FRlO ▶

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This project was commissioned by HP and AMD.