Benchmark test results: Copilot+ PCs from Microsoft compared to MacBook laptops and an older Microsoft device

In this report, we assess the following devices:

- Copilot+ PCs running Windows 11 Pro
  - Microsoft Surface Laptop 15”
  - 2x Microsoft Surface Laptop 13.8"
  - 2x Microsoft Surface Pro
- Older Microsoft laptops running Windows 10 Pro
  - Microsoft Surface Laptop 3
- Apple® MacBook® laptops running macOS® Sequoia
  - Apple MacBook Air® 13" with Apple M2
  - 2x Apple MacBook Air 15" with Apple M2
  - 2x Apple MacBook Air 13" with Apple M3
  - 2x Apple MacBook Air 15" with Apple M3
  - 2x Apple MacBook Pro® 14" with Apple M3
  - 2x Apple MacBook Pro® 14” with Apple M3 Pro
  - 2x Apple MacBook Pro® 16” with Apple M3 Pro
  - Apple MacBook Pro® 16” with Apple M3 Pro Max

We used one benchmark for performance testing:

- Cinebench 2024

We tested battery life with two different tests:

- Windows ADK battery test – Web browsing, which Microsoft created and has used extensively (Copilot+ PCs only)
- Windows ADK battery test – Local video playback, which Microsoft created and has used extensively (Copilot+ PCs only)

We ran the benchmark on each device three times; here, we report the average scores we saw across the three runs. Because the Windows ADK test uses Windows features, it does not run on macOS, so we ran it on only the Windows devices. For all results, higher is better. (The Time to shut down metric in Windows ADK battery life is a projection of how long the battery should last before the system shuts down.) Note that for some devices, we tested multiples of the same device, so in some tables, you may see multiple devices with the same name. For complete results and hardware/software disclosures, see the science behind the report.

Test results

Copilot+ PCs running Windows 11 Pro

Table 1: Results of our testing on the Microsoft Surface devices. Higher results are better. For complete results, see the science behind the report.

	Microsoft Surface Laptop 15"	Microsoft Surface Laptop 13.8"	Microsoft Surface Laptop 13.8"	Microsoft Surface Pro	Microsoft Surface Pro
Cinebench 2024					
Multi-core – Average	950.0	784.6	889.6	802.6	866.3
Single-core – Average	123.3	109.0	120.6	109.0	121.6
Windows ADK battery test – Web browsing (Battery Saver Dim OFF)					
Total duration (min) – Average	186.3	174.2	182.9	138.3	157.0
Projected time to shut down (min) – Average	850.0	838.6	810.6	630.0	660.3
Windows ADK battery test – Local video playback (Battery Saver Dim OFF)					
Total duration (min) – Average	232.6	213.9	210.4	177.2	210.6
Projected time to shut down (min) – Average	1,165.6	1,045.3	1,060.0	810.0	951.0

Older Microsoft device

Table 2: Results of our testing on the older Microsoft device we tested. For all results, higher is better. For complete results, see the science behind the report.

	Microsoft Surface Laptop 3
Cinebench 2024	
Multi-core – Average	208.0
Single-core – Average	72.6
Windows ADK battery test – Web browsing (Battery Saver Dim OFF)	
Total duration (min) – Average	83.6
Projected time to shut down (min) – Average	367.6
Windows ADK battery test – Local video playback (Battery Saver Dim OFF)	
Total duration (min) – Average	174.9
Projected time to shut down (min) – Average	666.0

Apple MacBook laptops

Table 3: Results of our testing on the Apple MacBook Air devices we tested. For all results, higher is better. For complete results, see the science behind the report.

	MacBook Air 13" Apple M2	MacBook Air 13" Apple M3	MacBook Air 13" Apple M3	MacBook Air 15" Apple M2	MacBook Air 15" Apple M2	MacBook Air 15" Apple M3	MacBook Air 15" Apple M3
Cinebench 2024							
Multi-core – Average	564.6	615.6	632.3	574.0	563.3	654.0	653.3
Single-core – Average	121.0	141.3	141.0	121.0	121.0	141.0	141.0

Table 4: Results of our testing on the Apple MacBook Pro devices we tested. For all results, higher is better. For complete results, see the science behind the report.

	MacBook Pro 14" Apple M3	MacBook Pro 14" Apple M3	MacBook Pro 14" Apple M3 Pro	MacBook Pro 14" Apple M3 Pro	MacBook Pro 16" Apple M3 Pro	MacBook Pro 16" Apple M3 Pro	MacBook Pro 16" Apple M3 Max
Cinebench 2024							
Multi-core – Average	618.6	594.0	1,049.6	1,051.3	1,065.3	1,055.3	1,466.0
Single-core – Average	141.0	141.0	139.3	139.3	142.0	141.0	142.0

Comparing the Copilot+ PCs to the older PC and the Apple MacBook laptops

Table 5: For all benchmarks, the lowest average result, the highest average result, and the average of average results for the Copilot+ PCs we tested, the older Microsoft system we tested, the MacBook Air devices we tested, and the MacBook Pro devices we tested. For all results, higher is better.

	Copilot+ PC (Microsoft) devices we tested	Older Microsoft systems we tested	MacBook Air systems we tested	MacBook Pro systems we tested
Cinebench 2024				
Multi-core – Lowest average across the group of devices	784.6	208.0	563.3	594.0
Multi-core – Highest average across the group of devices	950.0	208.0	654.0	1,466.0
Multi-core – Average of averages across the group of devices	858.6	208.0	608.1	985.7
Single-core – Lowest average across the group of devices	109.0	72.6	121.0	139.3
Single-core – Highest average across the group of devices	123.3	72.6	141.3	142.0
Single-core – Average of averages across the group of devices	116.6	72.6	132.4	140.8
Windows ADK battery test – Web browsing (Battery Saver Dim OFF)				
Total duration (min) – Lowest average across the group of devices	138.4	83.6		
Total duration (min) – Highest average across the group of devices	186.4	83.6		
Total duration (min) – Average of averages across the group of devices	167.8	83.6		
Projected time to shut down (min) – Lowest average across the group of devices	630.0	367.7		
Projected time to shut down (min) – Highest average across the group of devices	850.0	367.7		
Projected time to shut down (min) – Average of averages across the group of devices	757.9	367.7		
Windows ADK battery test – Local video playback (Battery Saver Dim OFF)				
Total duration (min) – Lowest average across the group of devices	177.2	174.9		
Total duration (min) – Highest average across the group of devices	232.7	174.9		
Total duration (min) – Average of averages across the group of devices	209.0	174.9		
Projected time to shut down (min) – Lowest average across the group of devices	810.0	666.0		
Projected time to shut down (min) – Highest average across the group of devices	1,165.7	666.0		
Projected time to shut down (min) – Average of averages across the group of devices	1,006.4	666.0		

The science behind the report

In this section, we list our complete results and describe the solutions on which we tested and our test methodologies.

We concluded our hands-on testing on May 23, 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 3, 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.

CoPilot+ PCs running Windows 11 Pro

Table 6: Results of our testing on the Microsoft Surface CoPilot+ PCs we tested. Higher is better.

	Microsoft Surface Laptop 15"	Microsoft Surface Laptop 13.8"	Microsoft Surface Laptop 13.8"	Microsoft Surface Pro	Microsoft Surface Pro
Cinebench 2024					
Multi-core – Run 1	946.0	792.0	895.0	802.0	862.0
Multi-core – Run 2	959.0	788.0	893.0	804.0	869.0
Multi-core – Run 3	945.0	774.0	881.0	802.0	868.0
Single-core – Run 1	123.0	109.0	120.0	109.0	120.0
Single-core – Run 2	123.0	109.0	122.0	109.0	121.0
Single-core – Run 3	124.0	109.0	120.0	109.0	124.0
Multi-core – Average	950.0	784.6	889.6	802.6	866.3
Single-core – Average	123.3	109.0	120.6	109.0	121.6

	Microsoft Surface Laptop 15"	Microsoft Surface Laptop 13.8"	Microsoft Surface Laptop 13.8"	Microsoft Surface Pro	Microsoft Surface Pro
Windows ADK battery test – Web browsing (Battery Saver Dim OFF)					
Total duration (min) - Run 1	204.5	164.4	189.4	132.2	150.2
Projected time to shut down (min) - Run 1	792.0	826.0	733.0	647.0	578.0
Total duration (min) - Run 2	166.9	175.2	175.4	152.1	179.6
Projected time to shut down (min) - Run 2	818.0	843.0	847.0	585.0	694.0
Total duration (min) - Run 3	187.8	183.0	184.0	130.7	141.3
Projected time to shut down (min) - Run 3	940.0	847.0	852.0	658.0	709.0
Total duration (min) – Average	186.3	174.2	182.9	138.3	157.0
Projected time to shut down (min) – Average	850.0	838.6	810.6	630.0	660.3
Windows ADK battery test – Local video playback (Battery Saver Dim OFF)					
Total duration (min) - Run 1	231.4	213.0	209.6	200.4	238.9
Projected time to shut down (min) - Run 1	1,168.0	1,044.0	1,061.0	775.0	927.0
Total duration (min) - Run 2	237.3	219.2	211.0	168.3	195.4
Projected time to shut down (min) - Run 2	1,180.0	1,047.0	1,070.0	833.0	987.0
Total duration (min) - Run 3	229.4	209.7	210.7	163.0	197.7
Projected time to shut down (min) - Run 3	1,149.0	1,045.0	1,049.0	822.0	939.0
Total duration (min) – Average	232.6	213.9	210.4	177.2	210.6
Projected time to shut down (min) – Average	1,165.6	1,045.3	1,060.0	810.0	951.0

Older Microsoft device

Table 7: Results of our testing on the older Microsoft device. Higher is better.

	Microsoft Surface Laptop 3
Cinebench 2024	
Multi-core – Run 1	211.0
Multi-core – Run 2	205.0
Multi-core – Run 3	208.0
Single-core – Run 1	73.0
Single-core – Run 2	73.0
Single-core – Run 3	72.0
Multi-core – Average	208.0
Single-core – Average	72.6
Windows ADK battery test – Web browsing (Battery Saver Dim OFF)	
Total duration (min) - Run 1	85.3
Projected time to shut down (min) - Run 1	320.0
Total duration (min) - Run 2	81.1
Projected time to shut down (min) - Run 2	393.0
Total duration (min) - Run 3	84.5
Projected time to shut down (min) - Run 3	390.0
Total duration (min) – Average	83.6
Projected time to shut down (min) – Average	367.6
Windows ADK battery test – Web browsing (Battery Saver Dim OFF)	
Total duration (min) - Run 1	173.8
Projected time to shut down (min) - Run 1	667.0
Total duration (min) - Run 2	171.9
Projected time to shut down (min) - Run 2	662.0
Total duration (min) - Run 3	179.1
Projected time to shut down (min) - Run 3	669.0
Total duration (min) – Average	174.9
Projected time to shut down (min) – Average	666.0

Apple MacBook laptops

Table 8: Results of our testing on the Apple MacBook Air devices. Higher is better.

	MacBook Air 13" Apple M2	MacBook Air 13" Apple M3	MacBook Air 13" Apple M3	MacBook Air 15" Apple M2	MacBook Air 15" Apple M2	MacBook Air 15" Apple M3	MacBook Air 15" Apple M3
Cinebench 2024							
Multi-core – Run 1	563.0	617.0	633.0	573.0	565.0	654.0	655.0
Multi-core – Run 2	566.0	616.0	633.0	576.0	562.0	654.0	655.0
Multi-core – Run 3	565.0	614.0	631.0	573.0	563.0	654.0	650.0
Single-core – Run 1	121.0	141.0	141.0	121.0	121.0	141.0	141.0
Single-core – Run 2	121.0	141.0	141.0	121.0	121.0	141.0	141.0
Single-core – Run 3	121.0	142.0	141.0	121.0	121.0	141.0	141.0
Multi-core – Average	**564.6**	**615.6**	**632.3**	**574.0**	**563.3**	**654.0**	**653.3**
Single-core – Average	**121.0**	**141.3**	**141.0**	**121.0**	**121.0**	**141.0**	**141.0**

Table 9: Results of our testing on the Apple MacBook Pro devices. Higher is better.

	MacBook Pro 14" Apple M3	MacBook Pro 14" Apple M3	MacBook Pro 14" Apple M3 Pro	MacBook Pro 14" Apple M3 Pro	MacBook Pro 16" Apple M3 Pro	MacBook Pro 16" Apple M3 Pro	MacBook Pro 16" Apple M3 Max
Cinebench 2024							
Multi-core – Run 1	626.0	589.0	1,051.0	1,041.0	1,066.0	1,045.0	1,462.0
Multi-core – Run 2	598.0	571.0	1,044.0	1,051.0	1,061.0	1,061.0	1,463.0
Multi-core – Run 3	632.0	622.0	1,054.0	1,062.0	1,069.0	1,060.0	1,473.0
Single-core – Run 1	141.0	141.0	140.0	140.0	142.0	141.0	143.0
Single-core – Run 2	141.0	141.0	139.0	139.0	142.0	141.0	141.0
Single-core – Run 3	141.0	141.0	139.0	139.0	142.0	141.0	142.0
Multi-core – Average	**618.6**	**594.0**	**1,049.6**	**1,051.3**	**1,065.3**	**1,055.3**	**1,466.0**
Single-core – Average	**141.0**	**141.0**	**139.3**	**139.3**	**142.0**	**141.0**	**142.0**

System configuration information

Table 10: Detailed information on the systems we tested.

System configuration information	Microsoft Surface Laptop 15"	Microsoft Surface Laptop 13.8"	Microsoft Surface Laptop 13.8"	Microsoft Surface Pro	Microsoft Surface Pro
Processor					
Vendor	Qualcomm®	Qualcomm	Qualcomm	Qualcomm	Qualcomm
Model number	Snapdragon® X Elite - X1E-80-100	Snapdragon X Plus - X1P-64-100	Snapdragon X Elite - X1E-80-100	Snapdragon X Plus - X1P-64-100	Snapdragon X Elite - X1E-80-100
Core frequency (GHz)	3.4	3.4	3.4	3.4	3.4
Number of cores	12	10	12	10	12
Number of Threads	12	10	12	10	12
Memory					
Amount (GB)	16	16	16	16	16
Type	LPDDR5X-8448	LPDDR5X-8448	LPDDR5X-8448	LPDDR5X-8448	LPDDR5X-8448
Graphics					
Vendor	Qualcomm	Qualcomm	Qualcomm	Qualcomm	Qualcomm
Model number	Adreno GPU	Adreno GPU	Adreno GPU	Adreno GPU	Adreno GPU
Storage					
Amount	1 TB	256 GB	1 TB	256 GB	512 GB
Type	Samsung® MZ9L41T0HBLB-00BMV	Samsung MZ9L4256HCJQ-00BMV	Samsung MZ9L41T0HBLB-00BMV	Samsung MZ9L4256HCJQ-00BMV	Samsung MZ9L4512HBLU-00BMV
Connectivity/expansion					
Wireless internet	Qualcomm 7800 Wi-Fi 7	Qualcomm 7800 Wi-Fi 7	Qualcomm 7800 Wi-Fi 7	Qualcomm 7800 Wi-Fi 7	Qualcomm 7800 Wi-Fi 7
Battery					
Rated capacity (Wh)	64	54	54	46	46
Display					
Size (inches)	15	13.8	13.8	13	13
Resolution	2,496 x 1,664	2,304 x 1,536	2,304 x 1,536	2,880 x 1,920	2,880 x 1,920

System configuration information	Microsoft Surface Laptop 15"	Microsoft Surface Laptop 13.8"	Microsoft Surface Laptop 13.8"	Microsoft Surface Pro	Microsoft Surface Pro
Operating system					
Vendor	Microsoft	Microsoft	Microsoft	Microsoft	Microsoft
Name	Windows 11 Pro Insider Preview	Windows 11 Pro Insider Preview	Windows 11 Pro Insider Preview	Windows 11 125 Pro Insider Preview	Windows Pro Insider Preview
Version	24H2 Build 26097.5003	24H2 Build 26097.5003	24H2 Build 26097.5003	24H2 Build 26097.5003	24H2 Build 26097.5003
BIOS					
BIOS name and version	OEMBR 110.1.235	OEMBR 110.1.235	OEMBR 110.1.235	OEMMN 110.2001.235	OEMMN 110.2001.235
Dimensions					
Height (inches)	0.72	0.69	0.69	0.37	0.37
Width (inches)	11.85	12.96	12.96	11.3	11.3
Depth (inches)	9.41	8.67	8.67	8.2	8.2
Weight (lbs.)	3.67	2.96	2.96	1.97	1.97

Table 11: Detailed information on the older system we tested.

System configuration information	Microsoft Surface Laptop 3
Processor	
Vendor	Intel
Model number	Core i7-1065G7
Core frequency	1.3-3.9
Number of cores	4
Number of Threads	8
Memory	
Amount (GB)	16
Type	DDR4-3733
Graphics	
Vendor	Intel

System configuration information	Microsoft Surface Laptop 3
Model number	Iris Plus Graphics
Storage	
Amount (GB)	512
Type	HFM512GDGTNG-87A0A
Connectivity/expansion	
Wireless internet	Intel Wi-Fi 6 AX201
Battery	
Rated capacity (Wh)	46
Display	
Size (inches)	13.5
Resolution	2,256 x 1,504
Operating system	
Vendor	Microsoft
Name	Windows 10 Pro
Version	22H2
BIOS	
BIOS name and version	Microsoft Corporation 19.100.140
Dimensions	
Height (inches)	0.57
Width (inches)	12.1
Depth (inches)	8.8
Weight (lbs.)	2.79

Table 12: Detailed information on the Apple MacBook Air systems we tested.

System configuration information	MacBook Air 13"	MacBook Air 13"	MacBook Air 13"	MacBook Air 15"	MacBook Air 15"	MacBook Air 15"	MacBook Air 15"
Processor							
Vendor	Apple	Apple	Apple	Apple	Apple	Apple	Apple
Model number	M2	M3	M3	M2	M2	M3	M3
Core frequency (GHz)	3.49	4.05	4.05	3.49	3.49	4.05	4.05
Number of cores	8	8	8	8	8	8	8
Memory							
Amount (GB)	8	8	8	8	8	8	8
Type	Unified	Unified	Unified	Unified	Unified	Unified	Unified
Graphics							
Vendor	Apple	Apple	Apple	Apple	Apple	Apple	Apple
Model number	M2 8-core GPU	M3 8-core GPU	M3 8-core GPU	M2 10-core GPU	M2 10-core GPU	M3 10 core GPU	M3 10-core GPU
Storage							
Amount (GB)	256	256	256	256	256	256	256
Type	SSD	SSD	SSD	SSD	SSD	SSD	SSD
Connectivity/expansion							
Wireless internet	Wi-Fi 6	Wi-Fi 6E	Wi-Fi 6E	Wi-Fi 6	Wi-Fi 6	Wi-Fi 6E	Wi-Fi 6E
Battery							
Rated capacity (Wh)	52.6	52.6	52.6	66.5	66.5	66.5	66.5
Display							
Size (inches)	13.6	13.6	13.6	15.3	15.3	15.3	15.3
Resolution	2,560 x 1,664	2,560 x 1,664	2,560 x 1,664	2,880 x 1,864	2,880 x 1,864	2,880 x 1,864	2,880 x 1,864
Operating system							
Vendor	Apple	Apple	Apple	Apple	Apple	Apple	Apple
Name	macOS Sonoma	macOS Sonoma	macOS Sonoma	macOS Sonoma	macOS Sonoma	macOS Sonoma	macOS Sonoma
Version	14.3.1	14.4	14.4	14.3.1	14.3.1	14.4	14.4

System configuration information	MacBook Air 13"	MacBook Air 13"	MacBook Air 13"	MacBook Air 15"	MacBook Air 15"	MacBook Air 15"	MacBook Air 15"
BIOS							
BIOS name and version	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dimensions							
Height (inches)	0.44	0.44	0.44	0.45	0.45"	0.45	0.45
Width (inches)	11.97	11.97	11.97	13.40	13.40	13.40	13.40
Depth (inches)	8.46	8.46	8.46	9.35	9.35	9.35	9.35
Weight (lbs.)	2.7	2.7	2.7	3.3	3.3	3.3	3.3

Table 13: Detailed information on the Apple MacBook Pro systems we tested.

System configuration information	MacBook Pro 14"	MacBook Pro 14"	MacBook Pro 14"	MacBook Pro 14"	MacBook Pro 16"	MacBook Pro 16"	MacBook Pro 16"
Processor							
Vendor	Apple	Apple	Apple	Apple	Apple	Apple	Apple
Model number	M3	M3	M3 Pro	M3 Pro	M3 Pro	M3 Pro	M3 Max
Core frequency (GHz)	4.05	4.05	4.05	4.05	4.05	4.05	4.05
Number of cores	8	8	12	12	12	12	14
Memory							
Amount (GB)	8	8	18	18	18	18	36
Type	Unified	Unified	Unified	Unified	Unified	Unified	Unified
Graphics							
Vendor	Apple	Apple	Apple	Apple	Apple	Apple	Apple
Model number	M3 10-core GPU	M3 10-core GPU	M3 Pro 18-core GPU	M3 Pro 18-core GPU	M3 Pro 18-core GPU	M3 Pro 18-core GPU	M3 Max 30-core GPU
Storage							
Amount (GB)	512 GB	512 GB	1 TB	1 TB	512 GB	512 GB	1 TB
Type	SSD	SSD	SSD	SSD	SSD	SSD	SSD
Connectivity/expansion							
Wireless internet	Wi-Fi 6E	Wi-Fi 6E	Wi-Fi 6E	Wi-Fi 6E	Wi-Fi 6E	Wi-Fi 6E	Wi-Fi 6E

System configuration information	MacBook Pro 14"	MacBook Pro 14"	MacBook Pro 14"	MacBook Pro 14"	MacBook Pro 16"	MacBook Pro 16"	MacBook Pro 16"
Battery							
Rated capacity (Wh)	70	70	72.4	72.4	100	100	100
Display							
Size (inches)	14.2	14.2	14.2	14.2	16.2	16.2	16.2
Resolution	3,024x1,964	3,024 x 1,964	3,024 x 1,964	3,024 x 1,964	3,456 x 2,234	3,456 x 2,234	3,456 x 2,234
Operating system							
Vendor	Apple	Apple	Apple	Apple	Apple	Apple	Apple
Name	macOS Sonoma	macOS Sonoma	macOS Sonoma	macOS Sonoma	macOS Sonoma	macOS Sonoma	macOS Sonoma
Version	14.3.1	14.3.1	14.3.1	14.3.1	14.3.1	14.3.1	14.3.1
BIOS							
BIOS name and version	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dimensions							
Height (inches)	0.61	0.61	0.61	0.61	0.66	0.66	0.66
Width (inches)	12.31	12.31	12.31	12.31	14.01	14.01	14.01
Depth (inches)	8.71	8.71	8.71	8.71	9.77	9.77	9.77
Weight (lbs.)	3.4	3.4	3.5	3.5	4.7	4.7	4.7

How we tested

Setting up the systems (Windows)

Setting up and updating the OEM image

1. Boot the system.
2. Follow the on-screen instructions to complete installation, using the default selections when appropriate.
3. Set the Windows (plugged in) Power Mode to Best Performance.
4. Set Screen and Sleep options to Never:
   - Right-click the desktop, and select Display settings.
   - Select System from the left-hand column.
   - Click Power & Battery.
   - 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. Verify the date and time are correct, and synchronize the system clock with the time server.
8. Pause Automatic Windows Updates.
   - Click the Windows Start button.
   - Type `Windows Update settings` and press Enter.
   - From the Pause updates drop-down menu, select Pause for 5 weeks.

Measuring performance (Windows)

Cinebench 2024 benchmark

Setting up the test

1. Download and install Cinebench from https://www.maxon.net/en/downloads/cinebench-2024-downloads.

Running the benchmark

1. Launch Cinebench.
2. Select File→Advanced benchmark.
3. Set the Minimum Test Duration to Off.
4. Select CPU (Multi Core), CPU (Single Core), or GPU, and click Start
5. Record the result.
6. Wait 15 minutes before re-running.
7. Repeat steps 1 through 6 twice more, and report the averages of the results.

Measuring battery life (Windows)

Windows ADK: Local video playback battery rundown

Setting up the test

1. Verify that the displays will remain constant during the test:
   - Right-click the desktop and select Display settings.
   - Uncheck the box next to Change brightness automatically when lighting changes, if available.
   - Uncheck the box next to Change brightness based on content, if available.
   - Select System from the left-hand column.
   - Click Power & Battery.
   - For all power options listed under Screen and Sleep, select Never.
   - Set Turn battery saver on automatically at 20%.
   - Uncheck the box next to Lower screen brightness when user battery saver.
2. Create a folder on the root of C:\ named data
3. Create a folder on the root of C:\ named adk
4. Place adk test files into the C:\data\ folder.
5. Move the contents of the EE_LFSVP_ToS folder into the C:\adk\ folder.
6. Using a nit meter, adjust the screen brightness to as close to 150 nits as possible.
7. Open PowerShell as administrator and run `Set-ExecutionPolicy bypass`
8. Type `A` to choose yes to all, and press enter.
9. Run `Get-ChildItem -Path 'C:\adk' -Recurse | Unblock-File`
10. Navigate to C:\data\prep\.
11. Enter `runme.bat` to run the system prep command.

Running the test

1. After the prep command completes, wait 2 minutes before proceeding.
2. Open an elevated command prompt.
3. Navigate to C:\adk\
4. With the system plugged in and charged to 100%, enter `runjob.cmd` to run the local video playback battery rundown test.
5. Click Run job on this computer.
6. Click Start.
7. At the Assessment is Beginning screen, click next.
8. When prompted to unplug the system, do so.
9. When the test completes, record the results.
10. Plug the system in and charge back to 100%.
11. Repeat steps 2 through 10 twice more, and report the averages of the results.

Windows ADK: Web Browsing battery rundown

Setting up the test

1. Verify that the displays will remain constant during the test:
   - Right-click the desktop, and select Display settings.
   - Uncheck the box next to Change brightness automatically when lighting changes, if available.
   - Uncheck the box next to Change brightness based on content, if available.
   - Select System from the left column.
   - Click Power & Battery.
   - For all power options listed under Screen and Sleep, select Never.
   - Set Turn battery saver on automatically at 20%.
   - Uncheck the box next to Lower screen brightness when user battery saver.
2. Using a nit meter, adjust the screen brightness to as close to 150 nits as possible.
3. Open Edge, and navigate to edge://settings/help to identify the version number for the Edge browser.
4. Apply any Edge updates that are available.
5. Open Device Manager, and make sure there are no yellow bangs or unknown devices.
6. Open the Microsoft Store, and update all applications.
7. Open PowerShell as administrator, and run `Set-ExecutionPolicy bypass`
8. Type `A` to choose yes to all, and press Enter.
9. Run `winget upgrade -all -include-unknown`
10. Open the system settings, and make sure the date and time are synchronized on the system under test.
11. Disable any keyboard backlights.
12. Make sure the Microsoft Edge language is set to English at edge://settings/languages
13. In the Edge settings, remove any profiles that have been added.
14. Open an elevated command prompt.
15. Navigate to C:\data\prep\
16. Enter `runme.bat` to run the system prep command.

Running the test

1. After the prep command completes, wait 2 minutes before proceeding.
2. Create a folder on the root of C:\ named data.
3. Place adk test files into the C:\data\ folder.
4. Navigate to https://developer.microsoft.com/en-us/microsoft-edge/tools/webdriver/
5. Download the appropriate x64 or ARM64 version of the webdriver that matches the current Edge version number.
6. Extract msedgedriver.exe to C:\data\test\bin\
7. Open the parameters.abl.credentials.json file located in C:\data\ asmt\Assessment2\scenarios in notepad and enter the credentials for the outlook.com account used.
8. Open an elevated command prompt.
9. Run `Get-ChildItem -Path 'C:\data' -Recurse | Unblock-File`
10. Navigate to C:\data\asmt\
11. Run `RunJobABLTraining.cmd`
12. Click Start.
13. At the Assessment Beginning screen, click Next.
14. Unplug the system when prompted.
15. When the training command is complete, plug the system back in, and make sure it charges to 100%.
16. Open an elevated command prompt.
17. Navigate to C:\data\asmt\
18. Run `RunJobABLTrained.cmd`
19. When the test is complete, record the results and copy the results folder to Documents.
20. Plug the system in, and charge it back to 100%.
21. Open Explorer, and delete the entire C:\data folder.
22. Repeat steps 1 through 21 twice more, and report the averages of the results.

Setting up the system (macOS)

Setting up and updating the OEM image

1. Boot the system.
2. Follow the on-screen instructions to complete installation, using the default selections when appropriate.
3. Set Screen and Sleep options to Never.
   - Select System Settings.
   - Select Lock Screen.
   - Change the following options to Never:
   - Start Screen Saver when inactive.
   - Turn display off on battery when inactive.
   - Turn display off on power adapter when inactive.
   - Require password after screen saver begins or display is turned off.
   - Return to System Settings and select Battery.
   - Set On power adapter setting to High Power (Note: this is not an option available on all Macs).
   - Click Options.
   - Disable the Slightly dim the display on battery option.
4. Disable automatically adjust brightness.
   - Select System Settings.
   - Select Display.
   - Disable Automatically adjust brightness.
5. Run Software Update, and install all updates available.
6. Verify the date and time are correct.
7. Enable Automatic log in.
   - Select System Settings.
   - Click Users & Groups.
   - Select the drop down menu next to the Automatically log in as setting, and select the User account.

8. Disable Automatic Mac Updates.
    - Select System Settings.
    - Click General.
    - Click on Software Update.
    - Click the information icon next to Automatic updates.
    - Disable Check for updates.

Measuring performance (macOS)

Cinebench 2024 benchmark

Setting up the test

1. Download and install Cinebench from https://www.maxon.net/en/downloads/cinebench-2024-downloads.

Running the benchmark

1. Launch Cinebench.
2. Select FileàAdvanced benchmark.
3. Set the Minimum Test Duration to Off.
4. Select either CPU (Multi Core), CPU (Single Core), or GPU, and click Start.
5. Record the result.
6. Wait 15 minutes before re-running.
7. Repeat steps 1 through 6 twice more, and report the averages of the results.

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