



The science behind the report: Intel Core processor-powered Chromebooks support your business

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 [Intel Core processor-powered Chromebooks support your business](#).

We concluded our hands-on testing on December 15, 2020. 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 December 7, 2020 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.

Table 1: Hand-timed results (in seconds) of our task sequence testing.

Task	Acer Chromebook™ Spin CP713-2W-5874 with an Intel® Core™ i5-10210U processor	HP Chromebook x360 14c-ca0053dx with an Intel Core i3-10110U processor	HP Chromebook 14A G5 TPM-Q216 with an AMD A6-9220C processor	Lenovo Chromebook Duet CT-X636F with a MediaTek Helio P60T processor	Intel processor-powered Chromebook percent less time
Scenario #1					
Median sum of all tasks in Scenario #1	47.7	63.8	82.3	64.8	Up to 42%
Google Meet™					
Launching Google Meet	1.8	2.0	3.4	2.7	Up to 47%
Launching a new Google Meet meeting	2.4	2.6	4.2	3.6	Up to 42%
Google Drive™					
Opening a PDF preview from Google Drive	4.8	5.7	8.5	5.8	Up to 43%
Viewing a PDF print preview	24.3	33.9	17.9	17.0	Up to 28%

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Google Sheets™					
Opening a shared Excel document with Google Drive	3.0	3.9	9.5	6.1	Up to 68%
Opening an Excel document in Google Sheets	11.4	15.7	38.8	29.6	Up to 70%
Scenario #2					
Median sum of all tasks in Scenario #2	27.2	33.3	62.4	49.9	Up to 56%
Google Slides					
Opening a shared Google Slides presentation	6.2	6.6	18.3	13.4	Up to 66%
Viewing a Google Slides presentation print preview	5.9	6.2	9.1	8.0	Up to 35%
Beginning a Google Slides presentation	6.1	10.2	15.3	14.5	Up to 60%
Google Drive					
Opening a link to a shared image	3.7	3.5	7.3	4.2	Up to 52%
Google Slides					
Inserting an image into a presentation	5.3	6.8	12.4	9.8	Up to 57%
Scenario #3					
Median sum of all tasks in Scenario #3	13.6	16.5	28.6	27.1	Up to 52%
Google Drive					
Opening a shared link to Word document	3.3	4.1	6.2	5.3	Up to 46%
Viewing a print preview of a Word document	4.9	6.6	8.3	9.6	Up to 49%
Opening a Word document in Google Docs	5.4	5.8	14.1	12.2	Up to 61%
Scenario #4					
Median sum of all tasks in Scenario #4	161.9	212.0	658.0	548.6	Up to 75%
Google System					
Unzipping 140 photos to desktop	5.4	6.2	35.2	22.7	Up to 84%
Adobe Lightroom®					
Importing 140 photos	74.8	107.5	234.1	241.4	Up to 69%
Batch-processing 140 photos with a filter preset	18.3	25.9	94.5	81.5	Up to 80%
Exporting 140 photos	54.8	62.6	279.0	189.2	Up to 80%

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Adobe Photoshop® Express					
Creating a nine-image collage	3.2	3.9	8.7	7.2	Up to 63%
Google Tour Creator					
Opening a Google Tour Creator template	5.4	5.9	6.5	6.6	Up to 18%

Table 2: Results of WebXPRT 3 benchmark testing.

	Acer Chromebook Spin CP713-2W-5874 with an Intel Core i5-10210U processor	HP Chromebook x360 14c-ca0053dx with an Intel Core i3-10110U processor	HP Chromebook 14A G5 TPM-Q216 with an AMD A6-9220C processor	Lenovo Chromebook Duet CT-X636F with a MediaTek Helio P60T processor	Intel processor-powered Chromebook percent less time
WebXPRT 3					
Chrome web browser score	185	176	78	61	Up to 67%

System configuration information

Table 3: Detailed information on the systems we tested.

System	Acer Chromebook Spin CP713-2W-5874 with an Intel Core i5-10210U processor	HP Chromebook x360 14c-ca0053dx with an Intel Core i3-10110U processor	HP Chromebook 14A G5 TPM-Q216 with an AMD A6-9220C processor	Lenovo Chromebook Duet CT-X636F with a MediaTek Helio P60T processor
Processor	Intel Core i5-10210U	Intel Core i3-10110U	AMD A6-9220C	MediaTek P60T
Processor frequency (GHz)	1.6	2.1	1.8	2.0
Processor cores	4	2	2	8
Memory (GB)	8	8	8	4
Storage (GB)	128	64	64	64
USB	2 x USB 3.1 Type-C, 1 x USB 3.1 Gen 1	2 x USB 3.1 Type-C	2 x USB 3.1 Type-C, 2 x USB 3.1 Gen 1	1 x USB 3.1 Type-C
Battery type	Lithium ion	Lithium ion	Lithium ion	Lithium ion
Battery capacity (Wh)	48	48	47	38
Display (in.)	13.5	14.0	14.0	10.1
Display resolution	2256 x 1054	1920 x 1080	1366 x 768	1920 x 1200
ChromeOS version	87.0.4280.109	87.0.4280.109	87.0.4280.88	87.0.4280.88
System weight (lbs.)	3.02	3.64	3.48	2.03

How we tested

Creating the background workload

To simulate typical Chromebook use, we ran a combination of news, email, chat, music, document viewing, and social media websites in the background. For websites that required accounts, we created test profiles and logged in the users on each device.

1. From the shelf, open Chromebook settings.
2. Navigate to the On Startup section of the settings.
3. Select Open a specific page or set of pages.
4. Insert the following URLs, and click OK.
 - a. [Forbes.com](https://www.forbes.com)
 - b. [Markets.ft.com/data](https://markets.ft.com/data)
 - c. [Arstechnica.com](https://www.arstechnica.com)
 - d. mail.google.com
 - e. slack.com (logged into Slack chat, #general channel)
 - f. drive.google.com
 - g. docs.google.com (viewing document)
 - h. youtube.com/feed/music
 - i. drive.google.com (viewing document)
 - j. sheets.google.com (viewing spreadsheet)
 - k. twitter.com
 - l. facebook.com
5. Restart the Chromebook. Before testing, navigate through each tab to ensure that both devices have fully loaded the same content.

Application Testing

For each task, we downloaded, installed, and pinned the requisite apps to the Chrome shelf. For applications that required accounts or Google Authentication, we created test profiles and logged in the users on each device. After one run of a given scenario, we reset the Chromebook and performed two additional runs.

PowerDirector

Exporting a video project

1. From the app shelf, launch PowerDirector.
2. Click New Project.
3. Enter a project name, and click the 16:9 aspect ratio.
4. From the media browser, navigate to the test video footage. To insert the video into the timeline, click the + icon.
5. In the top right, click the play icon.
6. Click the export icon.
7. Click Save to Gallery or SD Card.
8. Leave the default resolution. Simultaneously start the timer and click Produce.
9. When the video export completes, stop the timer.

Lexis Audio Editor

Opening an audio file

1. From the app shelf, launch Lexis Audio Editor.
2. Click Open.
3. Navigate to the device's download folder, and select the test audio file.
4. Simultaneously start the timer and click Open.
5. When the audio file has fully loaded, stop the timer.

Exporting an audio file

1. From the app shelf, launch Lexis Audio Editor.
2. Click Open.
3. Navigate to the device's download folder, and select the test audio file.
4. With the test audio file loaded, click Save.
5. From the Save menu, enter a file name.
6. Simultaneously start the timer and click Save.
7. When saving completes, stop the timer.

WebXPRT 3

Running WebXPRT 3

1. Power on the device, and log in.
2. Allow the device to idle for 10 minutes to clear any background startup activity.
3. Open the default web browser, and navigate to <https://www.principledtechnologies.com/benchmarkxpert/webxpert/>.
4. Click Run WebXPRT 3.
5. Click Continue.
6. Click Start.
7. When the test completes, record the score.

Multi-tasking Scenarios

For our multitasking tests, we opened Google Meet in Chrome, and joined a four-participant video meeting. Our Chrome tab contained the background workload we described at the beginning of this section. We tested each task for a given scenario sequentially

Scenario #1

Google Meet

Launching Google Meet

1. Simultaneously start the timer and launch the Meet app from the shelf.
2. When the app fully loads and the webcam preview appears, stop the timer.

Launching a new Google Meet session

1. From the Meet main screen, simultaneously start the timer, and click New meeting.
2. When the meeting invite code appears and the webcam preview refreshes, stop the timer.
3. For the remainder of our timings, we joined a four-way video Meet, and minimized the app.

Google Drive

Opening a PDF preview from Google Drive

1. From the Google Meet chat window, simultaneously start the timer, and click the link to the test PDF.
2. When the PDF preview fully loads in the web browser, stop the timer.

Viewing a print preview of a PDF

1. From the Google Meet chat window, click the link to the test PDF shared via Google Drive.
2. When the PDF loads, simultaneously start the timer and click the Print icon.
3. When the print preview fully loads, stop the timer.

Google Sheets

Opening a shared Excel file with Google Drive

1. From the Google Meet chat window, simultaneously start the timer and click the link to the test .csv file shared via Google Drive.
2. When the document preview fully loads, stop the timer.

Opening a shared Excel file In Google Sheets

1. From the Drive document preview, simultaneously start the timer and click Open in Sheets.
2. When the Google Sheets document fully loads, stop the timer.

Scenario #2

Google Slides

Opening a shared Google Slides presentation

1. From the Google Meet chat window, simultaneously start the timer and click the link to the Google Slides test document via Google Drive.
2. When the presentation fully loads, stop the timer.

Viewing a print preview of a Google Slides presentation

1. From the Google Meet chat window, click the link to the Google Slides test document via Google Drive.
2. When the Slides presentation loads, click the File dropdown menu.
3. Simultaneously start the timer and click Print.
4. When the print preview fully loads, stop the timer.

Beginning a Google Slides presentation

1. From the Google Meet chat window, click the link to the Google Slides test document via Google Drive.
2. Simultaneously start the timer and click the Present button.
3. When the presentation fully loads, stop the timer.

Google Drive

Opening a link to a shared image

1. From the Google Meet chat window, simultaneously start the timer and click the link to the Google Photos test image via Google Drive.
2. When the photo preview fully loads, stop the timer.

Google Slides

Inserting an image into a presentation

1. Navigate back to the Google Slides test presentation.
2. With the first slide selected, click Insert, click Image, and select Upload From Computer.
3. Click to select the test image.
4. Simultaneously start the timer and click Open.
5. When the image fully loads into the document, stop the timer.

Scenario #3

Google Drive

Opening a shared link to a Word document

1. From the Google Meet chat window, simultaneously start the timer and click the link to the test .docx file shared via Google Drive.
2. When the document preview fully loads, stop the timer.

Viewing a print preview of a Word document

1. From the document preview page, simultaneously start the timer and click the print icon.
2. When the print preview fully loads, stop the timer.

Opening a Word document In Google Docs

1. From the document preview page, simultaneously start the timer and click the Open with Google Docs button from the top menu.
2. When the Google Docs editor fully loads, stop the timer.

Scenario #4

Google System

Unzipping 140 photos from the desktop

1. From the Files application, navigate to the test archive location.
2. Double-click to open the test archive using the default system viewer.
3. Select the contents of the test archive, and click and drag the contents to an empty folder.
4. Simultaneously start the timer and unclick the dragged content.
5. When the copying files dialog completes, stop the timer.

Adobe Lightroom

Importing 140 photos

1. From the app shelf, launch Adobe Lightroom from the Chrome.
2. From the Adobe Lightroom home page, click the blue import photos icon.
3. Sort by Device Folders. To select the unarchived test photos, click the checkbox next to the folder name.
4. Simultaneously start the timer and click Add.
5. When the import dialog completes, stop the timer.

Batch-processing 140 photos with a filter preset

1. From the Adobe Lightroom home page, click the collection containing the test photos.
2. Click the first image.
3. Click the Adjustments icon.
4. To apply auto-adjustments, click Auto.
5. Click the menu button in the top right, and select Copy Settings.
6. Leave the default Copy Settings, and click OK.
7. To return to the collection view, click the back arrow.
8. Long-click the first photo to select it.
9. Click the menu button in the top right, and select Select All.
10. Click the menu button in the top right again, and select Paste Settings.
11. Simultaneously start the timer and click Apply.
12. When the processing dialog closes, and "Changes applied to 140 photos" appears, stop the timer.

Exporting 140 photos

1. From the Adobe Lightroom home page, click the collection containing the test photos.
2. Click to select the first image.
3. From the dropdown menu, click to Select All images.
4. With all images selected, click the Share icon.
5. From the Share dialog box, click Export As...
6. Leave the default settings. Simultaneously start the timer and click the checkmark icon.
7. When the export dialog completes, stop the timer.

Adobe Photoshop Express

Creating a nine-image collage

1. From the app shelf, launch Adobe Photoshop Express from the shelf.
2. Click the Collage icon in the bottom right.
3. Click to select the nine test images.
4. Simultaneously start the timer and click the next arrow.
5. When the collage fully loads, stop the timer.

Google Tour Creator

Opening a Google Tour Creator template

1. Open the Chrome Browser window, and navigate to the Google Tour Creator web application at <https://arvr.google.com>.
2. Click Get Started.
3. Click the Templates tab.
4. Simultaneously start the timer and click the New York City template.
5. When the template fully loads, stop the timer.

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