

Prepare a print preview and save 1.4 minutes

in Google Sheets™



Open an eBook and save 3.5 seconds

in Google Drive



Merge sound tracks and save 32.3 seconds

in SoundTrap

Less waiting, less frustration in the classroom

A Chromebook powered by the Intel Core i3-6100U processor completed many common tasks faster than an Arm Rockchip processor-based device

A comprehensive education will introduce students to tools they'll need to thrive in our rapidly changing society. The professional world relies on many software applications that didn't exist 15, 10, or even 5 years ago—and the students of today are sure to see even more tools arise during the course of their education.

These applications may present a learning curve for some students, but they cause even more frustration when they run on slow, unresponsive devices. To make the learning process more enjoyable, your school should consider investing in fast devices that support education without making students wait.

At Principled Technologies, we tested two Chromebooks to see which could complete common classroom tasks faster. One Chromebook was powered by the Intel Core i3-6100U processor, while the other used an Arm® Rockchip processor. In our tests, the Chromebook with the Intel processor completed tasks faster, an ability that could enable your students to take advantage of the latest tools without unnecessary frustration.

The following pages describe a fictional scenario in which middle school students, high school students, and their teachers use the Intel Core i3-6100U processor-powered Acer Chromebook 11 C771. Though the story may be hypothetical, it's based on PT facts. For more detailed testing information, see the [appendices](#) beginning on page 7.

Two students, one fast device

Brothers Corey and Adam are headed to school. Each of their backpacks carries a tool for student success: The Acer Chromebook 11 C771 powered by the Intel Core i3-6100U processor. Read on to see how these devices add value to each student's day.



Corey



Adam



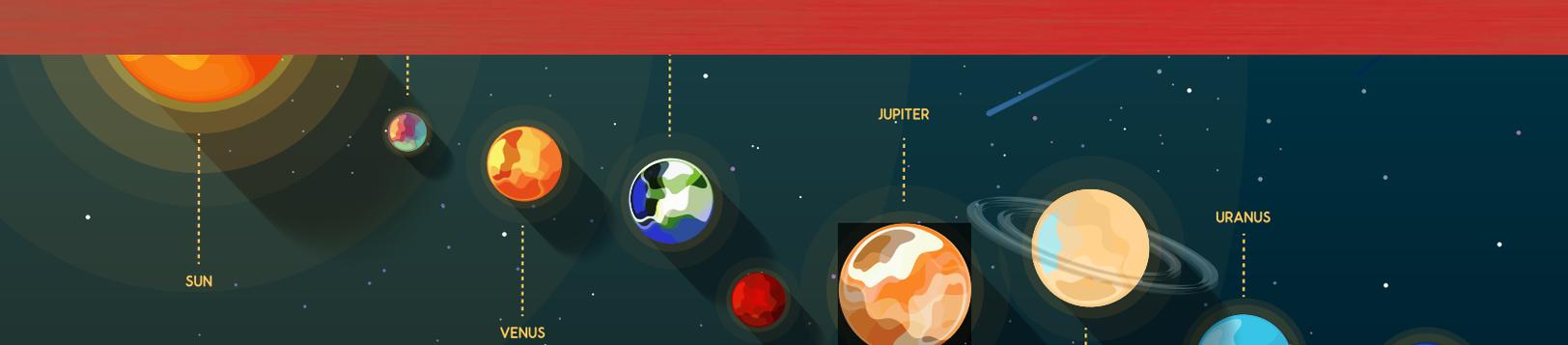
Chromebook with Intel Core
i3 processor



Android™ apps for Chromebooks

Google is rolling out support for Android apps on many Chromebook devices. Being able to install apps from the Google Play™ store opens your Chromebook to new possibilities and functionality you can't get with older or unsupported models.

To learn more about Android apps and the Chromebooks that support them, visit <https://sites.google.com/a/chromium.org/dev/chromium-os/chrome-os-systems-supporting-android-apps>.



Science class: Students and teachers don't wait on success

After homeroom, Corey heads to his seventh-grade science class, where he learns about the different types of celestial bodies in the universe. After a brief lecture, the kids load up their school-assigned Chromebooks and set to work on their projects: creating brochures for a destination in the Milky Way Galaxy.

Corey watches a Saturn-themed animated music video on the Scratch by MIT website for inspiration, which takes him almost seven fewer seconds than it would if he'd used an Arm Rockchip processor-based Chromebook.

Corey then creates a new Google Doc based on a brochure template, and starts to build a rough draft. Just before the bell, Corey finds a photo that would look perfect on the front page. He crops and rotates the image in Google Photos before saving it to his Drive before packing up and heading to lunch.

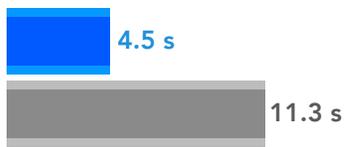
Corey's science teacher has a planning period right after class. When the last student leaves, she shuts her door and attends to her own work. She fires up her Intel processor-powered laptop before opening her lesson plan and associated materials in Google Docs. Soon, she realizes she needs to print handouts for the next class. The teacher quickly opens a PDF of the reading assignment and prints copies well in advance of the next bell.

All of these tasks would take longer with a Chromebook based on the Arm Rockchip processor. Being able to start tasks sooner can give teachers and students a better experience with their device.



Load project
in Scratch by MIT

Time (sec)
lower is better



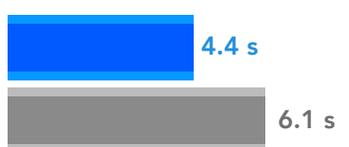
Save edited image
in Google Photos™

Time (sec)
lower is better



Open Google Docs file
in Google Drive

Time (sec)
lower is better



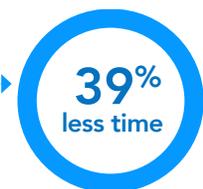
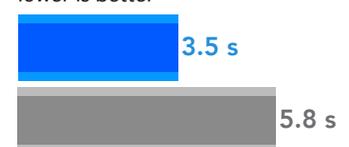
Load brochure template
in Google Docs™

Time (sec)
lower is better



Open Microsoft® Word file
in Google Drive

Time (sec)
lower is better



Load an eBook preview
in Google Drive

Time (sec)
lower is better



G Suite

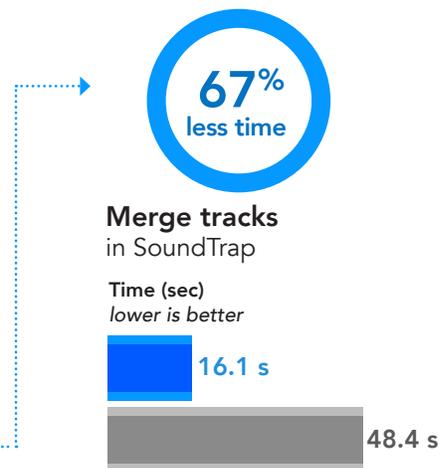
Colleges and universities use G Suite to give students and faculty access to intuitive productivity apps that promote a collaborative learning experience. To learn more about G Suite, visit <https://gsuite.google.com>. To see how the apps work in action, visit the Google Play store and give them a spin.



Music class: Edit digital works faster

Corey's older brother Adam goes to the high school across the street. After lunch, Adam heads to his digital music class, energized and ready to get to work.

In the music class, the students are learning how to make dubstep-style beats with the browser-based digital audio workstation SoundTrap. While working with the default dubstep project in the web application, Adam decides to combine multiple tracks so that he can work on their waveforms as one. It takes him 32 fewer seconds than it would if he'd used a Chromebook powered by an Arm Rockchip processor.





Create Facebook report
in Wolfram Alpha

Time (sec)
lower is better



Load proposal template
in Google Docs

Time (sec)
lower is better



Open large Microsoft Excel® file
in Google Sheets

Time (sec)
lower is better



Statistics class: Faster number crunching

In his statistics class, Adam's teacher tells the students they'll get to use Facebook in class today. The class whispers to each other in confusion before the teacher tells them what's really in store: the class will compile their Facebook usage data using Wolfram Alpha, then propose a project using data points from all the statistics students.

Adam logs into his Facebook account and uses the Wolfram Alpha web app to generate his own personal usage report. Rows of data on his posting habits and his most-liked content load on-screen. Adam thinks it might be interesting to see which variable has a greater effect on a post's popularity: the date and time or the number of friends a person has?

Adam starts working on his proposal—loading a template from Google Docs is over a second faster than it would have been with an Arm Rockchip processor-based device. Soon, the teacher gives a five-minute warning for the end of the school day. Adam uploads the data from his personal report to the master spreadsheet with info from every student.

 Chromebook with Intel Core i3-6100U processor

 Chromebook with Arm Rockchip processor

Keep working even after the bell

After class, the statistics teacher goes through the master spreadsheet and marvels at the wealth of information. He knows his students will make some insightful conclusions! After double-checking that all his students have put in their data, the teacher prints the spreadsheet for his records and saves the document. The teacher is using a Chromebook based on an Arm Rockchip processor, so it takes him almost a minute and a half longer to print the large spreadsheet and to save it.

After school, Adam decides to get a head start on his statistics project. The large file opens much more quickly than it would have on a Chromebook with an Arm Rockchip processor. The Intel Core i3-6100U processor-powered Chromebook allows Adam to begin manipulating data sooner and with less frustration.



Conclusion

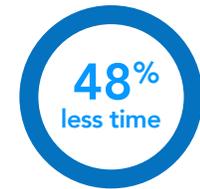
Students and teachers do a lot of their work on computers, so their Chromebooks need to be fast, not frustrating. Our tests showed that a Chromebook powered by the Intel Core i3-6100U processor completed many education tasks faster than a Chromebook powered by an Arm Rockchip processor, which could allow students to devote more time to projects and stay engaged and on task for longer. Teachers can also benefit from faster systems, such as while reviewing student work and creating class content. Though our scenario focused on a few specific classes, Chromebooks powered by an Intel Core i3-6100U processor could keep many students and teachers waiting less so they can focus on their work.



Prepare print preview
in Google Sheets

Time (sec)

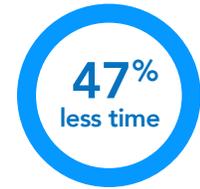
lower is better



Save Microsoft Excel file
in Google Sheets

Time (sec)

lower is better



Open Microsoft Excel file
in Google Drive

Time (sec)

lower is better



On November 13, 2017, we finalized the hardware and software configurations we tested. Updates for current and recently released hardware and software appear often, so unavoidably these configurations may not represent the latest versions available when this report appears. For older systems, we chose configurations representative of typical purchases of those systems. We concluded hands-on testing on November 15, 2017.

Appendix A: System configuration information

System	Acer Chromebook 11 C771	Samsung Chromebook Plus
Processor	Intel Core i3-6100U	Arm Rockchip OP1 (Rockchip RK3399-C)
Processor freq (GHz)	2.30	2.0
Processor cores	2	6
Memory (GB)	4	4
Storage (GB)	32	32
Battery type	Li-Polymer	Li-Ion
Battery capacity (Wh)	39	39
Display	11.6" 1,366x768	12.3" 2,400x1,600
Wireless	802.11 AC	802.11 AC
Bluetooth	4.0	4.0
USB ports	1x USB-C, 2x USB 3.0	2x USB-C
System weight (lbs.)	2.98	2.38
OS (version)	62.0.3202.97	62.0.3202.97
Build/firmware	Lars.7820.317.0	Kevin.8785.222.0

Appendix B: How we tested

Creating the background workload

To simulate typical Chromebook use, we ran a combination of news, email, chat, document viewing, music, 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, and select Open a specific page or set of pages.
3. Select Open a specific page or set of pages, insert the following URLs, and click OK.
 - forbes.com
 - markets.ft.com/data
 - arstechnica.com
 - mail.google.com
 - slack.com
 - drive.google.com
 - docs.google.com
 - youtube.com/feed/music
 - sheets.google.com
 - twitter.com
 - facebook.com
4. Restart the Chromebook. Before testing, navigate through each tab to ensure that both devices have fully loaded all the same content.

Testing each application

Google Sheets

Saving a large Google Sheet as Excel document

1. Install Google Sheets from the Google Play Store, and pin the app to the shelf.
2. Launch the app from the shelf, and click Skip to skip the tutorial.
3. Close the app and reopen it by clicking on the Sheets icon on the shelf.
4. From the recent files screen, click the test Sheet to open it.
5. Click the menu icon from the top navigation bar.
6. Click Share & export, and click Save As...
7. With Excel (.xlsx) selected, start the timer and click OK.
8. When the saving dialog closes, stop the timer.

Preparing a print preview (large document)

1. From the shelf, click the Google Sheets icon to launch the app.
2. From the recent files screen, click the test Sheet to open it.
3. Click the menu icon from the top navigation bar.
4. Click Share & export, start the timer, and click Print.
5. When the print preview fully loads, stop the timer.

Opening a large-sized spreadsheet (Excel)

1. From the shelf, click the Google Sheets icon to launch the app.
2. From the recent files screen, start the timer and click the test Excel sheet to open it.
3. When the Excel sheet fully loads, stop the timer.

Google Docs

Loading a project proposal template

1. From the Google Play store, install Google Docs, and pin the app to the shelf.
2. From the shelf, click the Google Docs icon to launch the app.
3. Click the red + icon.
4. Click Choose template.
5. Scroll down to the Work template category.
6. Start the timer, and click Project proposal (tropic).
7. When the template fully loads, stop the timer.

Loading the brochure (geometric) template

1. From the shelf, click the Google Docs icon to launch the app.
2. Click the red + icon.
3. Click Choose template.
4. Start the timer, and click Resume (Swiss).
5. When the template fully loads, stop the timer.

Google Photos

Saving an edited image as a copy

1. Install Google Photos from the Google Play Store, and pin the app to the shelf.
2. Launch the app from the shelf, and click Albums.
3. Click to open the Download folder.
4. Click to open the test image.
5. Click the pencil icon to open the editing menu.
6. Click Auto to apply automatic image correction.
7. Click the dropdown menu icon.
8. Start the timer, and click Save copy.
9. When the image finishes saving, stop the timer.

Google Drive

Opening a Google Docs document

1. Install Google Drive from the Google Play Store, and pin the app to the shelf.
2. Launch the app from the shelf.
3. From the files list, start the timer and click the test Google Doc.
4. When the document fully loads, stop the timer.

Opening an Excel Sheet in Google Sheets

1. Launch the app from the shelf.
2. From the files list, click the dropdown menu icon next to the test Excel sheet.
3. Start the timer, and click Open With.
4. When the sheet fully loads, stop the timer.

Opening a Word Doc in Google Docs

1. Launch the app from the shelf.
2. From the files list, click the dropdown menu icon next to the test Word document.
3. Start the timer, and click Open With.
4. When the document fully loads, stop the timer.

Loading a print preview for eBook PDF

1. Launch the app from the shelf.
2. From the files list, click the thumbnail for the test PDF.
3. When the PDF loads, click the dropdown menu icon.
4. Start the timer, and click Print.
5. When the print preview fully loads, stop the timer.

Scratch by MIT

Loading a featured project

1. From the Chrome browser, navigate to scratch.mit.edu.
2. Sign in with the test account.
3. Click on the search bar, and search for "Saturn."
4. Start the timer, and click "Saturn – an AMV."
5. Stop the timer when the flash animation fully loads.

Wolfram Alpha

Generating a Facebook report

1. From the Chrome browser, navigate to wolframalpha.com.
2. Sign in with the test account.
3. Click on the search bar, and search for "facebook report."
4. When the search results load, click Analyze My Facebook Data.
5. A prompt will appear to authorize connecting to a Facebook account. Click to continue with the test Facebook account.
6. Start the timer, and click Generate my Report.
7. Before the next test timing run, log in to the test Facebook account.
8. From the test Facebook account, click the help icon, Privacy Shortcuts, and click See More Settings.
9. From the Privacy Settings and Tools page, click Apps.
10. Click the X icon next to Wolfram Connection, and click Remove.

SoundTrap

Merging tracks in the Dubstep Demo

1. From the Chrome browser, navigate to soundtrap.com.
2. Sign in with the test account.
3. From the landing page, click Enter Studio.
4. From the template selection screen, click Dubstep DEMO.
5. Click Settings from the horizontal dropdown menu, and click Merge Tracks...
6. Check each instrument track to be merged.
7. With all tracks selected, start the timer and click Merge.
8. Stop the timer when merging completes.

This project was commissioned by Intel Corp.



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Benchmark results were obtained prior to implementation of recent software patches and firmware updates intended to address exploits referred to as "Spectre" and "Meltdown". Implementation of these updates may make these results inapplicable to your device or system.