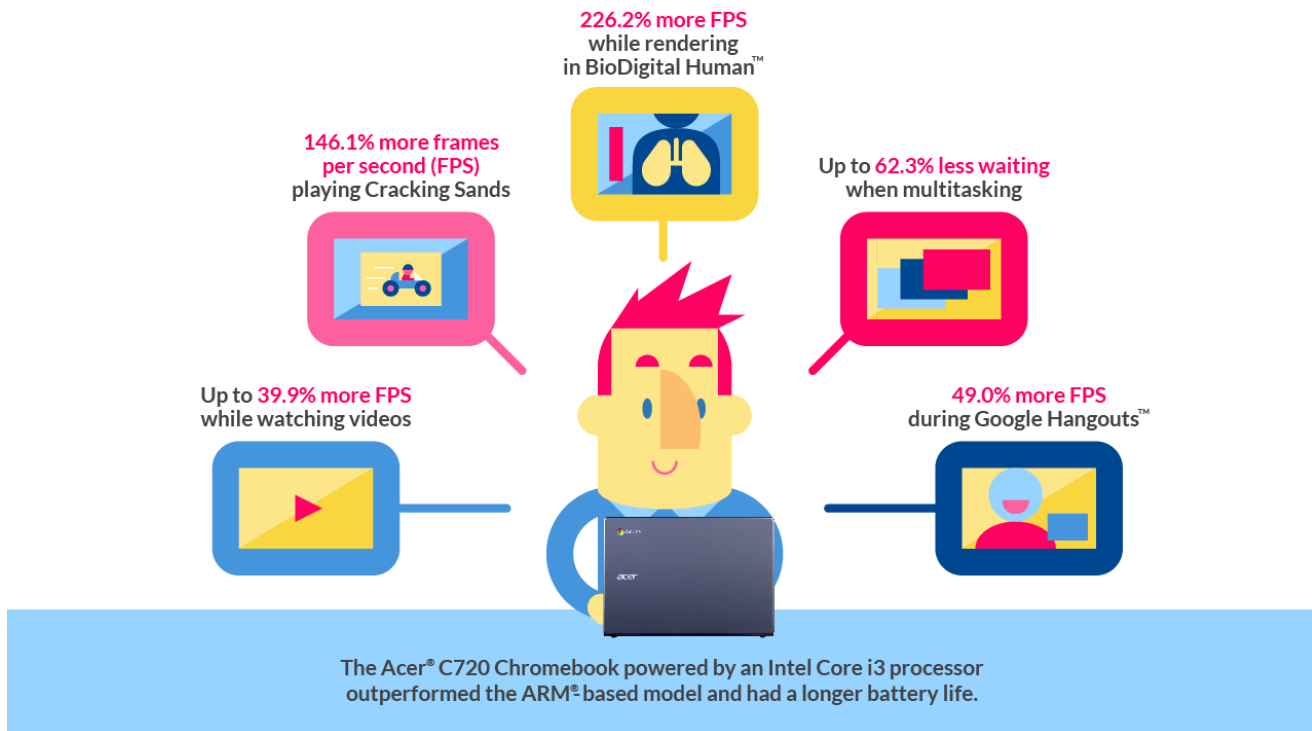


COMPARING CHROMEBOOKS FOR CONSUMERS: INTEL CORE i3 VS. ARM

Experience more on an Intel® Core™ i3 processor-powered Chromebook™



You've decided to get a Chromebook, but after seeing the available options, you can't decide which to get. What's important for you—do you want to spend less time opening and loading applications and Web sites? Are you a multitasker that needs to switch back and forth from playing games to watching videos to chatting with friends in a Google Hangouts call? Do you worry about battery life?

Here in the Principled Technologies labs, we looked at an Intel Core i3 processor-powered Chromebook and an ARM processor-based Chromebook. We put both systems through consumer scenarios that included common tasks such as playing a game, watching a video, and chatting with a friend in a Google Hangouts call. We looked at different aspects of user experience—measuring frame rate, time to complete tasks, and battery life.

Which Chromebook is the better choice? We found that the Intel Core i3 processor-powered Chromebook outperformed the ARM processor-based Chromebook across the board while also lasting 42 minutes longer in our battery life test. The Intel Core i3 processor-powered Chromebook delivered significantly more frames per second in a number of use cases, including chatting in a Google Hangouts call, playing a game, watching a video, and working in BioDigital Human. We also found the Intel Core i3 processor-powered Chromebook was about twice as fast as the ARM processor-based Chromebook, taking only about half as much time to complete tasks in four scenarios.



CHOOSING THE RIGHT CHROMEBOOK

There are many options when it comes to choosing a Chromebook. To help with the buying decision, we looked at two Chromebooks, comparing one with an Intel Core i3 processor and one with the latest ARM processor. We put the two Chromebooks through scenarios that included common tasks such as playing a game, watching a video, and chatting with a friend in a Google Hangouts call. We looked at things that matter to user experience, including frame rate during gaming and video playback. For more on how we tested, see [Appendix B](#). For detailed results, see [Appendix C](#).

We chose two systems that were as comparable as possible, and these systems share the same display size, display resolution, and amount of memory. The Intel Core i3 processor-powered Chromebook has twice the amount of storage (32 GB) and a battery with a slightly smaller capacity (3,950 mAh) than the ARM processor-based Chromebook. For more information on the two systems, see [Appendix A](#).

HANGING OUT AT HOME

Sofia is using her Chromebook while watching an awards show on TV. She checks both Facebook and Twitter to see what her friends and people she is following are saying about the show. After seeing a few tweets about some breaking sports news, she goes to ESPN® and watches a video with some commentary about the story. She starts a game in Bejeweled® and then stops to answer a Google Hangouts call from her mom.

Hanging out at home

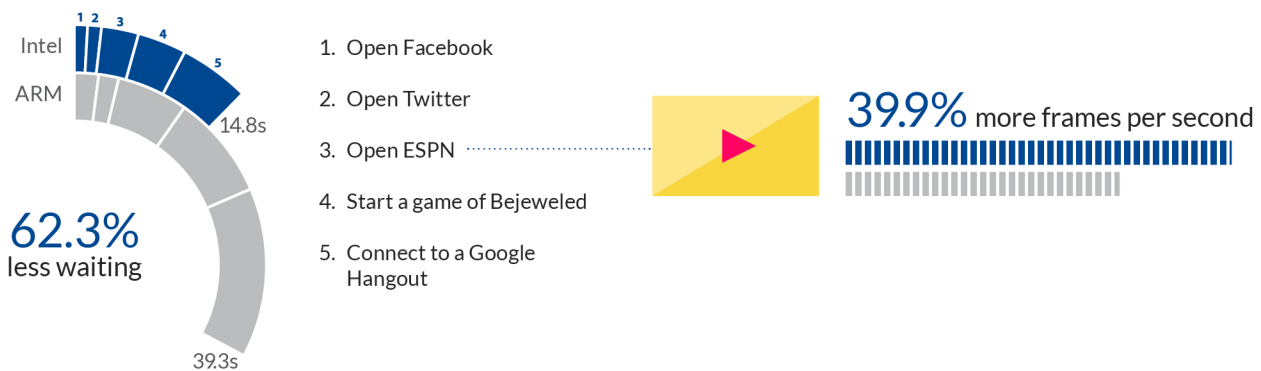


Figure 1: How the two Chromebooks compared while hanging out at home. For frames per second, higher numbers are better. For time to complete tasks, lower numbers are better.

As Figure 1 shows, the Intel Core i3 processor-powered Chromebook outperformed the ARM processor-based Chromebook across the board, delivering 39.9 percent more frames per second while playing a video and taking 62.3 percent less time to complete the tasks in the scenario. Sofia would definitely notice the difference between the two systems—it took over 11 seconds longer to connect to the Google Hangouts call on the ARM processor-based Chromebook.

PLANNING A HOUSEWARMING PARTY

Ryan checks his email, and then opens Google Calendar™ to figure out what date he wants to have his housewarming party. He opens a Google Docs™ document and adds a few more items to the list of things he needs to get for the party. Somewhat unfamiliar with the area around his new house, Ryan goes to Google Maps™ and searches for the nearest warehouse club. He opens Pandora® to listen to some music, and then starts playing his favorite racing game—Cracking Sands. He stops playing to answer a Google Hangouts call from his friend, who wants to see the new place.

Planning a housewarming party

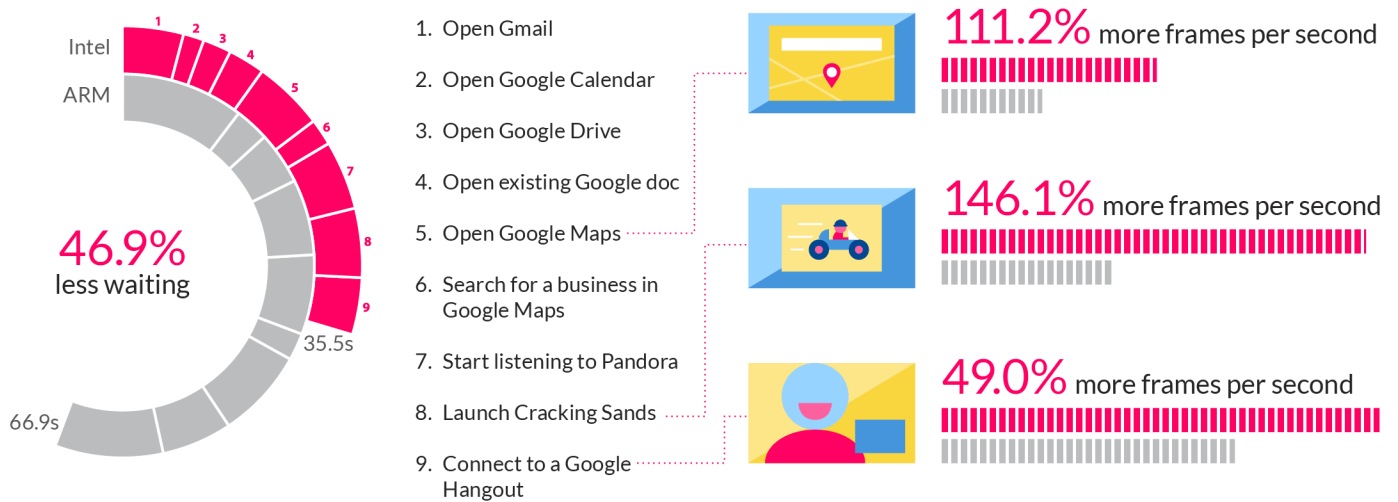


Figure 2: How the two Chromebooks compared while planning a housewarming party. For frames per second, higher numbers are better. For time to complete tasks, lower numbers are better.

As Figure 2 shows, the Intel Core i3 processor-powered Chromebook was better in every task, delivering 49.0 percent more frames per second during a Google Hangouts call, 146.1 percent more frames per second when playing Cracking Sands, and 111.2

percent more frames per second when zooming in Google Maps. We observed a significant difference between the two systems—Ryan would notice Cracking Sands running much more smoothly when using the Intel Core i3 processor-powered Chromebook.

DOING SCIENCE HOMEWORK

Emma opens her Chromebook and powers it on to do some science homework. She opens Gmail™ to double-check what her reading assignment is for the day, and goes to her Kno™ online textbook. She opens Google Drive™ and then opens a new document in Google Docs to take notes. She reads and takes notes for a while, and then comes upon something she doesn't know, so she searches Wikipedia® for it. She opens the BioDigital Human app to work with a 3D model. When she reaches a stopping point with BioDigital Human, Emma plays a Khan Academy® video about the types of muscles that her teacher shared with the class.

Doing science homework

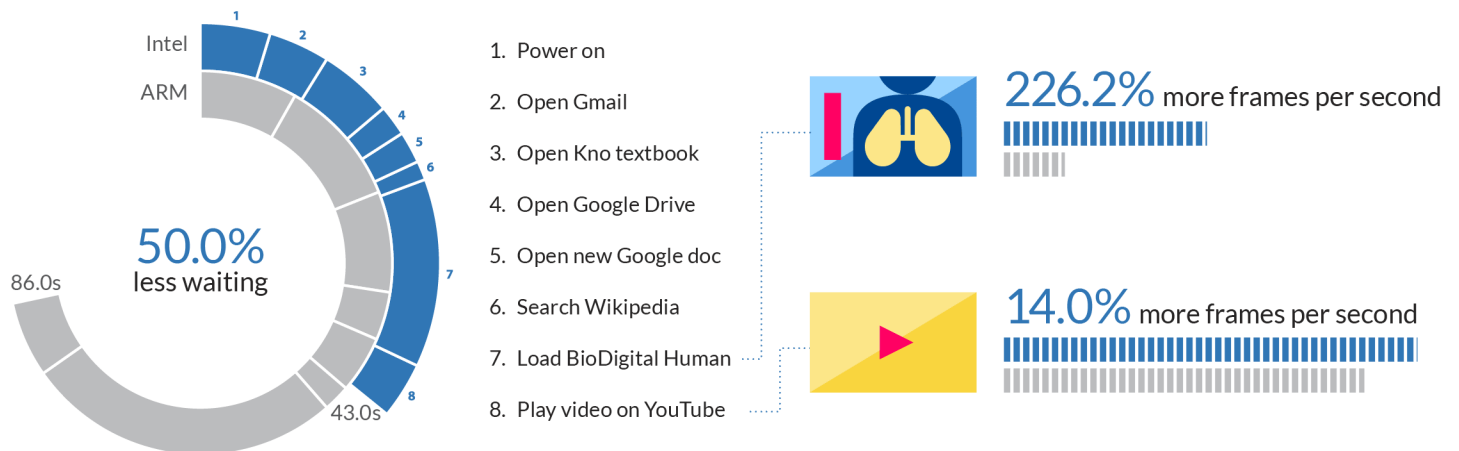


Figure 3: How the two Chromebooks compared while doing science homework. For frames per second, higher numbers are better. For time to complete tasks, lower numbers are better.

As Figure 3 shows, the Intel Core i3 processor-powered Chromebook completed the eight tasks in the scenario twice as fast as the ARM processor-based Chromebook, and delivered 226.2 percent more frames per second when zooming in on the digestive system in BioDigital Human. Emma would notice a difference when loading the human

in BioDigital Human, which took almost 17 seconds longer on the ARM processor-based Chromebook.

DRAFTING A FANTASY FOOTBALL TEAM

Darren opens Gmail to look at the mock draft results, and jots down a couple players he and his friend want to target for their league. He opens Google Calendar to double-check the draft time, and then pulls up a spreadsheet of player action values that he had put together with his friend. He checks for any breaking stories on ESPN, and watches a video about a player dealing with an injury suffered in a preseason game. After watching the video, he starts playing a podcast with thoughts on updated player rankings. When the draft room is open, Darren joins the draft and then answers a Google Hangouts call from his friend. He shares his screen in the call so that they can both view the draft together.

Drafting a fantasy football team

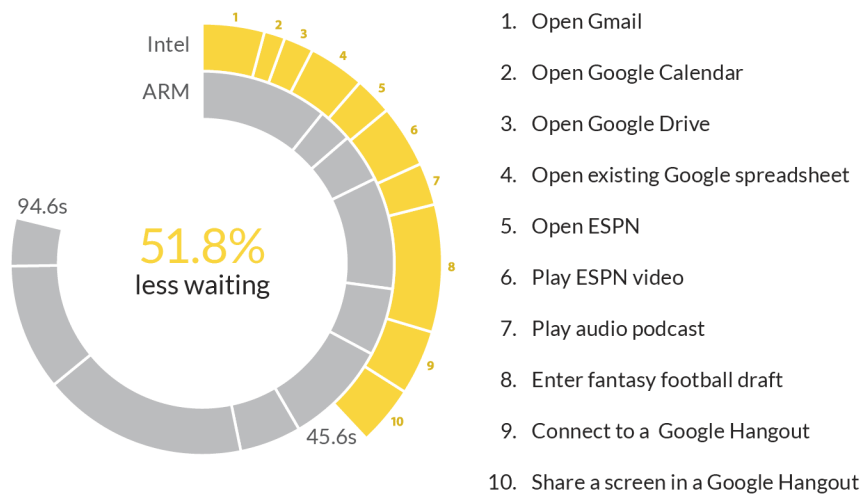


Figure 4: How the two Chromebooks compared while drafting a fantasy football team. For time to complete tasks, lower numbers are better.

As Figure 4 shows, the Intel Core i3 processor-powered Chromebook would give Darren a much better experience when drafting his fantasy football team with his friend. For the ten tasks in the scenario, the Intel Core i3 processor-powered Chromebook would save him just under 50 seconds in comparison to the ARM processor-based Chromebook. Darren wouldn't enjoy waiting 10 seconds longer to join

the draft on the ARM processor-based Chromebook, and over 7 seconds longer to connect to the Google Hangouts call after joining the draft.

BATTERY LIFE WHILE BROWSING

Battery life matters—no one wants to run out of a charge in the middle of something like a Google Hangouts call or a fantasy football draft. Not only did the Intel Core i3 processor-powered Chromebook deliver better performance, but as Figure 5 shows, we found that it also delivered longer battery life. The Intel Core i3 processor-powered Chromebook lasted 42 minutes longer in our battery life test—9 hours and 41 minutes versus just under 9 hours for the ARM processor-based Chromebook.

7.8% longer battery life



Figure 5: The amount of time the two Chromebooks lasted unplugged while lightly browsing the Internet. Higher numbers are better.

THE BOTTOM LINE

Which Chromebook model is the better choice? We put two Chromebook models to the test, and found that the Intel Core i3 processor-powered Chromebook offered a better user experience than the ARM processor-based Chromebook. The Intel Core i3 processor-powered Chromebook was better across the board, delivering more frames per second in a number of use cases, including Google Hangouts calls, online video content, games, and education apps. We also found the Intel Core i3 processor-powered Chromebook lasted longer in our battery life test and completed tasks in the four scenarios in about half the time that it took the ARM processor-based Chromebook.

APPENDIX A: DETAILED SYSTEM CONFIGURATION

Figure 6 presents detailed information on the two Chromebooks we tested.

| System | Intel Core i3 processor-powered Chromebook | ARM processor-based Chromebook |
|-----------------------------|--|--------------------------------------|
| Vendor and model | Acer C720-34041 | Samsung XE503C12-K01US |
| Processor | Intel Core i3-4005U | Samsung Exynos® 5 Octa 5420 |
| Processor frequency (GHz) | 1.7 | 1.3 Quad + 1.9 Quad |
| Processor cores | 2 | 4 + 4 |
| Memory amount (GB) | 4 | 4 |
| Storage amount (GB) | 32 | 16 |
| Battery type | 3 cell Li-Polymer | 2 cell Li-Polymer |
| Battery capacity (mAh) | 3,950 | 4,080 |
| Display size and resolution | 11.6" (1,366 × 768) | 11.6" (1,366 × 768) |
| Wireless | 802.11 a/b/g/n) | 802.11ac (802.11 a/b/g/n compatible) |
| Bluetooth® | 4.0 | 4.0 |
| USB ports | 1 × USB 3.0 1 × USB 2.0 | 1 × USB 3.0 1 × USB 2.0 |
| System weight | 2.76 lbs. | 2.65 lbs. |
| OS | Chrome OS™ version 36.0.1985.143 | Chrome OS version 36.0.1985.143 |
| Firmware | Google_Peppy.4389.86.0 | Google_Peach_Pit.4482.94.0 |

Figure 6: Detailed configuration information for the two Chromebooks.

APPENDIX B: DETAILED TEST METHODOLOGY

Scenario 1: Hanging out at home

1. Open Google Chrome™ from the shelf, and type `facebook.com` in the omnibox.
2. Simultaneously start the timer and press Enter.
3. When the page is fully displayed, stop the timer, and record the result.
4. Press Ctrl+T to open a new Chrome tab, and type `twitter.com` in the omnibox.
5. Simultaneously start the timer and press Enter.
6. When the page is fully displayed, stop the timer, and record the result.
7. Press Ctrl+T to open a new Chrome tab, and type `espn.go.com` in the omnibox.
8. Simultaneously start the timer and press Enter.
9. When the page is fully displayed, stop the timer, and record the result.
10. Simultaneously start the timer and select the play button to start the lead video.
11. Using a camera, capture the frames per second displayed in the counter at 20 seconds, 30 seconds, 40 seconds, 50 seconds, and 60 seconds.
12. Take the average of those five data points, and record the result.
13. Simultaneously start the timer and open Bejeweled from the apps list.
14. When the splash screen is fully displayed, stop the timer, and record the result.
15. On a Windows® client, start a new Google Hangouts call and send an invite to the test system.
16. On the test system, simultaneously start the timer and select Answer to join the call.
17. When the call is fully connected, stop the timer, and record the result.
18. Leave the call on the test system, and end the call on the Windows client.
19. Complete steps 1 through 18 two more times.

Scenario 2: Planning a housewarming party

1. Simultaneously start the timer and open Gmail from the shelf.
2. When all email messages and conversations are fully displayed, stop the timer, and record the result.
3. Simultaneously start the timer and open Google Calendar from the apps list.
4. When the page is fully displayed, stop the timer, and record the result.
5. Simultaneously start the timer and open Google Drive from the apps list.
6. When the page is fully displayed, stop the timer, and record the result.
7. Simultaneously start the timer and open the existing Google Docs document from Google Drive.
8. When the document is fully displayed, stop the timer, and record the result.
9. Simultaneously start the timer and open Google Maps from the apps list.
10. When the map is fully drawn and the page is fully displayed, stop the timer, and record the result.
11. Type `Sam's Club Morrisville, NC` in the search box.
12. Simultaneously start the timer and press Enter.
13. Take note of the lowest number of frames per second displayed in the counter during the zoom animation and redrawing of the map, and record the result.
14. When the map is fully redrawn and the page is fully displayed, stop the timer, and record the result.
15. Simultaneously start the timer and open Pandora from the apps list.
16. When the artist radio starts playing, stop the timer, and record the result.

17. Simultaneously start the timer and open Cracking Sands from the apps list.
18. When the splash screen is fully displayed, stop the timer, and record the result.
19. Maximize the Chrome browser window.
20. Select Single Race, and select Time Trial.
21. Simultaneously start the timer and select Start Race.
22. Using a camera, capture the frames per second displayed in the counter at 20 seconds, 30 seconds, 40 seconds, 50 seconds, and 60 seconds.
23. Take the average of those five data points, and record the result.
24. On the Windows client, start a new Google Hangouts call and send an invite to the test system.
25. On the test system, simultaneously start the timer and select Answer to join the call.
26. When the call is fully connected, stop the timer, and record the result.
27. Maximize the Google Hangouts call window.
28. Start the timer.
29. Using a camera, capture the frames per second displayed in the counter at 20 seconds, 30 seconds, 40 seconds, 50 seconds, and 60 seconds.
30. Take the average of those five data points, and record the result.
31. Leave the call on the test system, and end the call on the Windows client.
32. Complete steps 1 through 31 two more times.

Scenario 3: Doing science homework

1. Simultaneously start the timer and power on the system.
2. When the login window appears, stop the timer, and record the result.
3. Enter the password, and press Enter.
4. Simultaneously start the timer and open Gmail from the shelf.
5. When all email messages and conversations are fully displayed, stop the timer, and record the result.
6. Press Ctrl+T to open a new Chrome tab.
7. Type `kno.com` and press Enter.
8. Select Course Manager.
9. Simultaneously start the timer and select the Campbell Biology textbook under My Stuff.
10. Simultaneously start the timer and open Google Drive from the apps list.
11. When the page is fully displayed, stop the timer, and record the result.
12. Select Create.
13. Simultaneously start the timer and select Document to open a new Google Docs document.
14. When the document is fully displayed, stop the timer, and record the result.
15. Press Ctrl+T to open a new Chrome tab.
16. Type `Wikipedia.org` and press Enter.
17. Type `muscles` into the search field, and simultaneously start the timer and press Enter.
18. When the Wikipedia page is fully displayed, stop the timer, and record the result.
19. Open the Chrome tab for the Kno textbook.
20. Open the Chrome tab for the document.
21. Simultaneously start the timer and open BioDigital Human from the apps list.
22. When the page is fully displayed and the human begins to rotate, stop the timer, and record the result.

23. Show the Digestive System.
24. To zoom in on the stomach and surround organs, double-click the stomach.
25. Take note of the lowest number of frames per second displayed in the counter during the zoom animation, and record the result.
26. Simultaneously start the timer and open YouTube™ from the shelf.
27. Click Watch Later.
28. Play the Khan Academy Three Types of Muscle video.
29. When the video begins playing, stop the timer, and record the result.
30. Start the timer.
31. Using a camera, capture the frames per second displayed in the counter at 20 seconds, 30 seconds, 40 seconds, 50 seconds, and 60 seconds.
32. Take the average of those five data points, and record the result.
33. Complete steps 1 through 32 two more times.

Scenario 4: Drafting a fantasy football team

1. Simultaneously start the timer and open Gmail from the shelf.
2. When all email messages and conversations are fully displayed, stop the timer, and record the result.
3. Simultaneously start the timer and open Google Calendar from the apps list.
4. When the page is fully displayed, stop the timer, and record the result.
5. Simultaneously start the timer and open Google Drive from the apps list.
6. When the page is fully displayed, stop the timer, and record the result.
7. Simultaneously start the timer and open the existing Google Sheets spreadsheet from Google Drive.
8. When the spreadsheet is fully displayed, stop the timer, and record the result.
9. Press Ctrl+T to open a new Chrome tab, and type `espn.go.com` in the omnibox.
10. Simultaneously start the timer and press Enter.
11. When the page is fully displayed, stop the timer, and record the result.
12. Select Fantasy & Games, select Football, and select Draft Kit.
13. Under Quick Links, open the fantasy video archives in a new tab.
14. Simultaneously start the timer and select the Cam Newton video under Quarterbacks.
15. Select the play button to start the video.
16. When the video begins playing, stop the timer, and record the result.
17. Start the timer.
18. Using a camera, capture the frames per second displayed in the counter at 20 seconds, 30 seconds, 40 seconds, 50 seconds, and 60 seconds.
19. Take the average of those five data points, and record the result.
20. In the search box in the top-right corner, type `fantasy focus football` and press Enter.
21. Select Audio to display audio podcasts.
22. Simultaneously start the timer and select the audio podcast from August 25, 2014.
23. When the audio podcast begins playing, stop the timer, and record the result.
24. Pause the audio podcast.
25. Press Ctrl+T to open a new Chrome tab.
26. Type `games.espn.com/ffl/mockdraftlobby` in the omnibox, and press Enter.

27. Select an available 10-team league with snake draft type.
28. Wait for the countdown timer to reach 00:00:00.
29. Simultaneously start the timer and select Launch Draft.
30. When the fantasy draft is fully displayed, stop the timer, and record the result.
31. On the Windows client, start a new Google Hangouts call and send an invite to the test system.
32. On the test system, simultaneously start the timer and select Answer to join the call.
33. When the call is fully connected, stop the timer, and record the result.
34. Maximize the Google Hangouts call window.
35. Simultaneously start the timer and select Screenshot.
36. Select the ESPN Fantasy Snake Draft window, and press Enter.
37. When the fantasy draft is fully displayed on the Windows client, stop the timer, and record the result.
38. Complete steps 1 through 37 two more times.

Battery life while browsing

Setting up the test

1. Make sure the display will not automatically turn off during the test.
 - a. Install the Keep Awake extension.
 - b. To switch to the sun icon, click the icon in the top-right corner of the Chrome browser.
2. Open Google Chrome from the shelf, and bookmark the msn.com Web site.
3. Set the displays to as close as possible to 70 nits.
4. Plug the Chromebook chargers into a power strip.
5. Make sure the batteries are all 100 percent charged.
6. Place both Chromebooks next to the clock.

Running the test

1. Start the video camera.
2. Open Google Chrome from the shelf, and go to the bookmarked Web site.
3. Turn the power strip off, and note the time.
4. After both Chromebooks have fully discharged, review the video to determine when each Chromebook powered off.
5. Fully charge the Chromebooks.
6. Complete steps 1 through 5 two more times.

APPENDIX C: DETAILED RESULTS

Figure 7 presents the detailed results, with the time to complete tasks in the scenarios reported in seconds, and battery life while browsing reported in hours. We performed all tasks three times and used the median scores.

| | Intel Core i3 processor-powered Chromebook | ARM processor-based Chromebook |
|---|--|--------------------------------|
| Hanging out at home | | |
| Time to open Facebook (lower is better) | | |
| Run 1 | 00:01.06 | 00:02.58 |
| Run 2 | 00:00.96 | 00:02.36 |
| Run 3 | 00:01.06 | 00:02.44 |
| Median | 00:01.06 | 00:02.44 |
| Time to open Twitter (lower is better) | | |
| Run 1 | 00:01.14 | 00:02.01 |
| Run 2 | 00:01.12 | 00:02.10 |
| Run 3 | 00:01.12 | 00:02.03 |
| Median | 00:01.12 | 00:02.03 |
| Time to open ESPN (lower is better) | | |
| Run 1 | 00:03.08 | 00:07.18 |
| Run 2 | 00:03.01 | 00:07.37 |
| Run 3 | 00:02.94 | 00:07.14 |
| Median | 00:03.01 | 00:07.18 |
| Frames per second when playing ESPN video (higher is better) | | |
| Run 1 | 38.6 | 28.8 |
| Run 2 | 40.6 | 28.2 |
| Run 3 | 40.3 | 29.7 |
| Median | 40.3 | 28.8 |
| Time to start game in Bejeweled (lower is better) | | |
| Run 1 | 00:03.95 | 00:10.47 |
| Run 2 | 00:03.96 | 00:10.67 |
| Run 3 | 00:03.94 | 00:10.58 |
| Median | 00:03.95 | 00:10.58 |
| Time to connect to Google Hangouts call (lower is better) | | |
| Run 1 | 00:05.61 | 00:17.47 |
| Run 2 | 00:05.69 | 00:16.72 |
| Run 3 | 00:05.76 | 00:17.11 |
| Median | 00:05.69 | 00:17.11 |
| Total time for five tasks in the scenario | 00:14.83 | 00:39.34 |
| Planning a housewarming party | | |
| Time to open Gmail (lower is better) | | |
| Run 1 | 00:04.93 | 00:12.59 |
| Run 2 | 00:04.87 | 00:12.30 |
| Run 3 | 00:05.05 | 00:12.41 |
| Median | 00:04.93 | 00:12.41 |
| Time to open Google Calendar (lower is better) | | |
| Run 1 | 00:01.68 | 00:03.49 |
| Run 2 | 00:01.79 | 00:03.49 |
| Run 3 | 00:01.62 | 00:03.44 |
| Median | 00:01.68 | 00:03.49 |

| | Intel Core i3 processor-powered Chromebook | ARM processor-based Chromebook |
|---|--|--------------------------------|
| Time to open Google Drive (lower is better) | | |
| Run 1 | 00:02.33 | 00:05.31 |
| Run 2 | 00:02.20 | 00:05.20 |
| Run 3 | 00:02.30 | 00:05.43 |
| Median | 00:02.30 | 00:05.31 |
| Time to open existing Google Docs document (lower is better) | | |
| Run 1 | 00:03.09 | 00:07.66 |
| Run 2 | 00:02.97 | 00:07.66 |
| Run 3 | 00:02.98 | 00:07.66 |
| Median | 00:02.98 | 00:07.66 |
| Time to open Google Maps (lower is better) | | |
| Run 1 | 00:05.84 | 00:08.06 |
| Run 2 | 00:05.70 | 00:07.97 |
| Run 3 | 00:05.72 | 00:08.06 |
| Median | 00:05.72 | 00:08.06 |
| Time to search for business in Google Maps (lower is better) | | |
| Run 1 | 00:02.17 | 00:02.75 |
| Run 2 | 00:02.12 | 00:02.94 |
| Run 3 | 00:02.15 | 00:02.74 |
| Median | 00:02.15 | 00:02.75 |
| Frames per second when zooming in Google Maps (higher is better) | | |
| Run 1 | 32.2 | 10.7 |
| Run 2 | 21.6 | 11.6 |
| Run 3 | 22.6 | 10.7 |
| Median | 22.6 | 10.7 |
| Time to play artist radio on Pandora (lower is better) | | |
| Run 1 | 00:05.58 | 00:08.88 |
| Run 2 | 00:05.52 | 00:09.25 |
| Run 3 | 00:05.66 | 00:09.10 |
| Median | 00:05.58 | 00:09.10 |
| Time to launch Cracking Sands (lower is better) | | |
| Run 1 | 00:05.59 | 00:07.20 |
| Run 2 | 00:05.57 | 00:07.11 |
| Run 3 | 00:05.66 | 00:07.12 |
| Median | 00:05.59 | 00:07.12 |
| Frames per second when playing Cracking Sands (higher is better) | | |
| Run 1 | 44.7 | 18.0 |
| Run 2 | 44.3 | 18.8 |
| Run 3 | 44.3 | 18.0 |
| Median | 44.3 | 18.0 |
| Time to connect to Google Hangouts call (lower is better) | | |
| Run 1 | 00:04.61 | 00:10.95 |
| Run 2 | 00:04.61 | 00:10.82 |
| Run 3 | 00:04.75 | 00:11.00 |
| Median | 00:04.61 | 00:10.95 |

| | Intel Core i3 processor-powered Chromebook | ARM processor-based Chromebook |
|--|--|--------------------------------|
| Frames per second during Google Hangouts call (higher is better) | | |
| Run 1 | 45.8 | 30.8 |
| Run 2 | 45.9 | 31.6 |
| Run 3 | 46.4 | 30.0 |
| Median | 45.9 | 30.8 |
| Total time for nine tasks in the scenario | 00:35.54 | 01:06.85 |
| Doing science homework | | |
| Time to turn on system (lower is better) | | |
| Run 1 | 00:05.77 | 00:09.76 |
| Run 2 | 00:05.62 | 00:09.85 |
| Run 3 | 00:05.65 | 00:09.88 |
| Median | 00:05.65 | 00:09.85 |
| Time to open Gmail (lower is better) | | |
| Run 1 | 00:04.83 | 00:12.92 |
| Run 2 | 00:04.96 | 00:13.13 |
| Run 3 | 00:05.06 | 00:12.91 |
| Median | 00:04.96 | 00:12.92 |
| Time to open Kno.com textbook (lower is better) | | |
| Run 1 | 00:05.86 | 00:10.13 |
| Run 2 | 00:05.99 | 00:10.29 |
| Run 3 | 00:06.07 | 00:10.15 |
| Median | 00:05.99 | 00:10.15 |
| Time to open Google Drive (lower is better) | | |
| Run 1 | 00:02.49 | 00:04.86 |
| Run 2 | 00:02.54 | 00:04.79 |
| Run 3 | 00:02.45 | 00:04.91 |
| Median | 00:02.49 | 00:04.86 |
| Time to open new Google Docs document (lower is better) | | |
| Run 1 | 00:02.55 | 00:05.76 |
| Run 2 | 00:02.57 | 00:05.84 |
| Run 3 | 00:02.57 | 00:05.69 |
| Median | 00:02.57 | 00:05.76 |
| Time to search Wikipedia (lower is better) | | |
| Run 1 | 00:01.54 | 00:02.73 |
| Run 2 | 00:01.58 | 00:02.71 |
| Run 3 | 00:01.49 | 00:02.71 |
| Median | 00:01.54 | 00:02.71 |
| Time to load human in BioDigital Human (lower is better) | | |
| Run 1 | 00:15.22 | 00:32.09 |
| Run 2 | 00:15.14 | 00:32.24 |
| Run 3 | 00:15.36 | 00:31.89 |
| Median | 00:15.22 | 00:32.09 |
| Frames per second when viewing human in BioDigital Human (higher is better) | | |
| Run 1 | 21.2 | 6.4 |
| Run 2 | 21.4 | 6.9 |
| Run 3 | 21.2 | 6.5 |
| Median | 21.2 | 6.5 |

| | Intel Core i3 processor-powered Chromebook | ARM processor-based Chromebook |
|--|--|--------------------------------|
| Time to play Khan Academy video on YouTube (lower is better) | | |
| Run 1 | 00:04.44 | 00:07.62 |
| Run 2 | 00:04.56 | 00:07.68 |
| Run 3 | 00:04.57 | 00:07.56 |
| Median | 00:04.56 | 00:07.62 |
| Frames per second when playing Khan Academy video on YouTube (higher is better) | | |
| Run 1 | 43.3 | 37.8 |
| Run 2 | 43.1 | 38.3 |
| Run 3 | 43.0 | 37.8 |
| Median | 43.1 | 37.8 |
| Total time for eight tasks in the scenario | 00:42.98 | 01:25.96 |
| Drafting a fantasy football team | | |
| Time to open Gmail (lower is better) | | |
| Run 1 | 00:04.93 | 00:12.98 |
| Run 2 | 00:05.02 | 00:12.88 |
| Run 3 | 00:05.19 | 00:12.90 |
| Median | 00:05.02 | 00:12.90 |
| Time to open Google Calendar (lower is better) | | |
| Run 1 | 00:01.75 | 00:03.40 |
| Run 2 | 00:01.64 | 00:03.62 |
| Run 3 | 00:01.69 | 00:03.49 |
| Median | 00:01.69 | 00:03.49 |
| Time to open Google Drive (lower is better) | | |
| Run 1 | 00:02.49 | 00:04.90 |
| Run 2 | 00:02.40 | 00:04.86 |
| Run 3 | 00:02.38 | 00:05.16 |
| Median | 00:02.40 | 00:04.90 |
| Time to open existing Google Sheets spreadsheet (lower is better) | | |
| Run 1 | 00:04.58 | 00:11.37 |
| Run 2 | 00:04.52 | 00:11.28 |
| Run 3 | 00:04.62 | 00:11.23 |
| Median | 00:04.58 | 00:11.28 |
| Time to open ESPN (lower is better) | | |
| Run 1 | 00:03.29 | 00:06.76 |
| Run 2 | 00:03.01 | 00:06.82 |
| Run 3 | 00:03.08 | 00:06.87 |
| Median | 00:03.08 | 00:06.82 |
| Time to play ESPN video (lower is better) | | |
| Run 1 | 00:05.06 | 00:10.56 |
| Run 2 | 00:05.11 | 00:10.38 |
| Run 3 | 00:05.02 | 00:10.53 |
| Median | 00:05.06 | 00:10.53 |

| | Intel Core i3 processor-powered Chromebook | ARM processor-based Chromebook |
|---|--|--------------------------------|
| Time to play audio podcast (lower is better) | | |
| Run 1 | 00:03.46 | 00:06.21 |
| Run 2 | 00:03.21 | 00:06.19 |
| Run 3 | 00:03.42 | 00:06.30 |
| Median | 00:03.42 | 00:06.21 |
| Time to enter fantasy football draft (lower is better) | | |
| Run 1 | 00:10.31 | 00:20.65 |
| Run 2 | 00:10.16 | 00:20.77 |
| Run 3 | 00:10.45 | 00:20.81 |
| Median | 00:10.31 | 00:20.77 |
| Time to connect to Google Hangouts call (lower is better) | | |
| Run 1 | 00:05.24 | 00:12.82 |
| Run 2 | 00:05.25 | 00:12.88 |
| Run 3 | 00:04.98 | 00:12.49 |
| Median | 00:05.24 | 00:12.82 |
| Time to share screen in Google Hangouts call (lower is better) | | |
| Run 1 | 00:05.01 | 00:04.86 |
| Run 2 | 00:04.76 | 00:05.25 |
| Run 3 | 00:04.82 | 00:04.86 |
| Median | 00:04.82 | 00:04.86 |
| Total time for ten tasks in the scenario | 00:40.80 | 01:29.72 |
| Battery life while browsing | | |
| Battery life while browsing the Internet (higher is better) | | |
| Run 1 | 09:22:00.00 | 08:55:00.00 |
| Run 2 | 09:44:00.00 | 08:59:00.00 |
| Run 3 | 09:41:00.00 | 09:17:00.00 |
| Median | 09:41:00.00 | 08:59:00.00 |

Figure 7: Detailed results.

ABOUT PRINCIPLED TECHNOLOGIES



Principled Technologies, Inc.
1007 Slater Road, Suite 300
Durham, NC, 27703
www.principledtechnologies.com

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