SPEND MORE TIME WORKING LESS TIME WAITING

with the Intel®-powered Chromebook™

58% LONGER *battery life while browsing the Web*

50% LESS WAITING *to draft a business proposal*

50% LESS WAITING *to plan a business event*

51% LESS WAITING *to crunch the numbers*

52% LESS WAITING *to build a marketing plan*

compared to the ARM®-based model in every workflow we tested
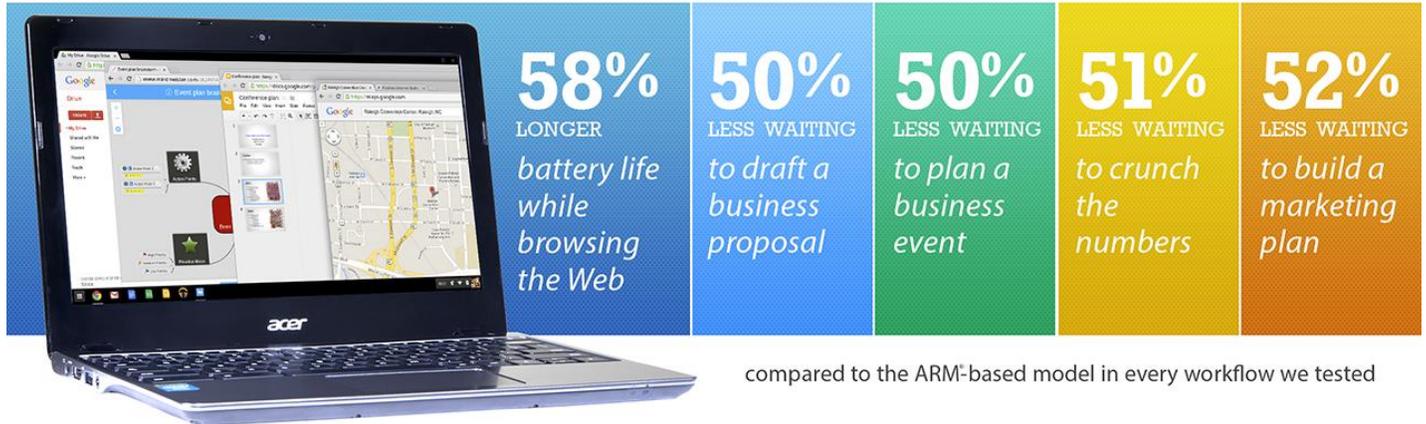
Small business employees don't have time to waste. They have business deals to close, deadlines and performance objectives to meet, projects to manage, and sales to make. In the middle of a busy workday, they simply want to pick up their device and move from one task to another quickly and easily. They don't want to waste valuable time, getting frustrated while waiting for apps or documents to open. Small business owners also need this–the less time their employees spend waiting on their devices, the sooner they can start working and the more productive they can be. They want devices that will help their employees get work done instead of getting in the way of them working.

If a small business decides to purchase Chromebooks for their staff, which model is the best choice? We put an Intel processor-powered Chromebook and an ARM processor-based model through employee workflows that included common tasks such as collaborating with colleagues and working in documents, presentations, and spreadsheets. We also looked at how long the two Chromebooks could keep running on a single charge.

We found that the Intel processor-powered Chromebook powered through our tests, moving through four employee workflows with up to 52 percent less waiting than the ARM processor-based Chromebook model. It also lasted 58 percent longer on a single charge while browsing the Web. The bottom line: small business employees can spend less time waiting and more time working with the Intel processor-powered Chromebook.

LESS WAITING WITH THE RIGHT CHROMEBOOK

Small businesses have many choices in Chromebook models as more enter the market. We chose an Intel processor-powered Chromebook and an ARM-based model that share the same display size and amount of memory and storage, and put the two systems through representative workflows containing tasks that small business employees would perform during the workday.

We also looked at how long each system could run on a single charge while browsing the Internet. In addition to the difference in processor, the two systems differ in battery size, as the Intel processor-powered Chromebook has a 3-cell battery, while the ARM-based model has a 2-cell battery. For more on the representative systems, see Appendix A. For more on how we tested, see Appendix B. For detailed results, see Appendix C.

BATTERY LIFE WHILE BROWSING

Battery life matters for small business employees, as they are often on the go—they can't afford for their devices to run out of juice during the workday, especially when meeting with new clients or up against a tight deadline. We found that the Intel processor-powered Chromebook lasted 58 percent longer than the ARM processor-based Chromebook while browsing the Internet—an additional 4 hours and 3 minutes without a charge (see Figure 1).
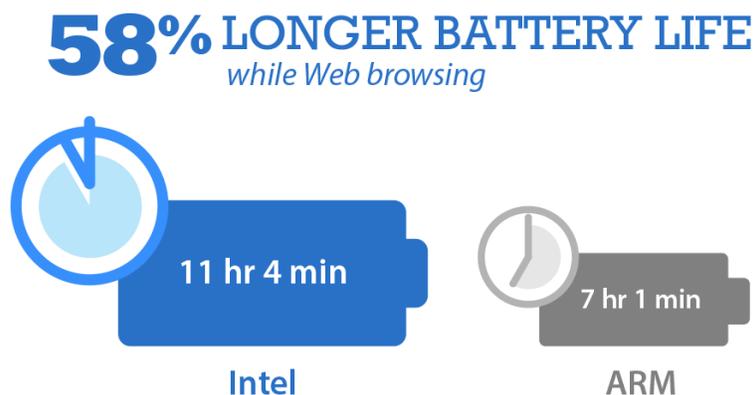

58% LONGER BATTERY LIFE
while Web browsing

11 hr 4 min — Intel

7 hr 1 min — ARM

Figure 1: The amount of time the two Chromebooks lasted unplugged while browsing the Internet.

DRAFTING A BUSINESS PROPOSAL

Jada opens her Chromebook and powers it on at the beginning of her workday at the branch office. She opens Google Keep™ to review some notes she took during a call with a client the previous day. She opens a new document in Google Docs to draft a proposal for a potential engagement with that client. While working on the document,

she looks at a PowerPoint® presentation in Google Drive™ Viewer that the client sent to her. She then checks Amazon.com to verify the cost of a product her company would need to purchase for the engagement. She finishes a draft proposal just before a meeting to discuss it with her partner. Carlos answers the scheduled Google Hangouts™ call, and adds the Google Docs document to the call so that they can review it together. After the call, she edits the proposal to incorporate feedback and then saves the Google Docs document as a Word document to send to the client. She opens her cloud CRM app to update some information about the sales opportunity. Before heading home, Jada pulls up her Harvest timesheet to catch up on her hours.
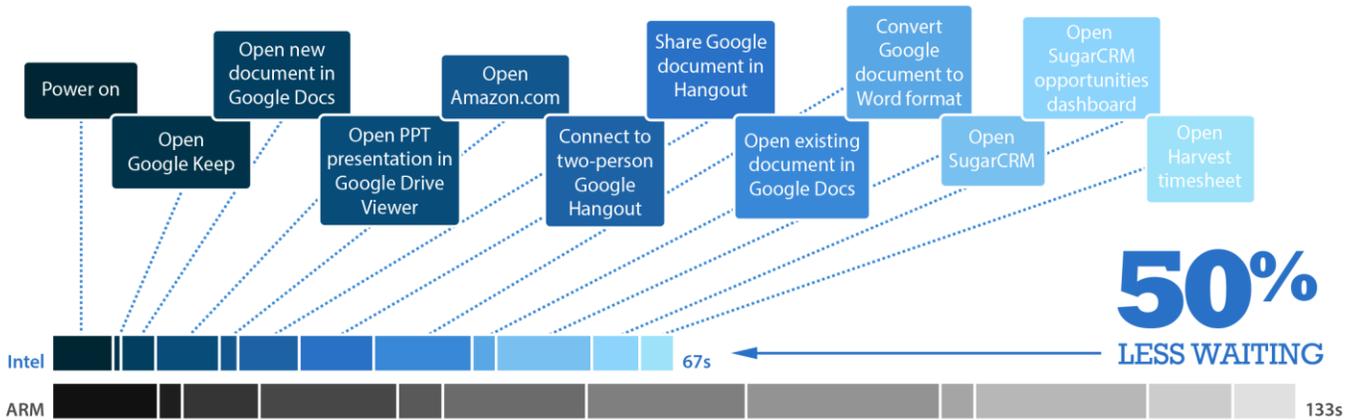
Drafting a business proposal

Figure 2: The amount of time spent waiting by the two Chromebooks in twelve tasks while drafting a business proposal.

> Jada would save almost 12 seconds when opening and loading the CRM dashboard on the Intel processor-powered Chromebook.

As Figure 2 shows, the Intel processor-powered Chromebook moved through the workflow with 50 percent less waiting than the ARM processor-based Chromebook. If Jada were using the Intel processor-powered Chromebook, she would spend half as much time waiting on her Chromebook. Instead of spending extra time waiting for the system to share her proposal in the Google Hangouts call, Jada could be going over it with her partner. With the Intel processor-powered Chromebook, she wouldn't have to wait almost 12 extra seconds to open her CRM app and load the opportunities dashboard.

PLANNING A BUSINESS EVENT

Carlos powers on his Chromebook after arriving at the local coffee shop to do some work. He jumps into his HootSuite™ dashboard to check recent social media activity and to make a couple posts. While working in HootSuite, he opens Picasa™ to look through photos he took during a recent conference. He opens Google Forms to create a survey and gather feedback from his team on the conference. To prepare for an

upcoming event, he opens a MindMeister brainstorming mind map and a presentation in PowerPoint Online that he has been working on the past couple days. To look at the list of venue options that his team put together for the upcoming event, Carlos also brings up an Excel® spreadsheet in Excel Online. He opens Google Maps™ and looks at the venue options near the convention center. While working on the presentation during his lunch, he opens Pandora® to listen to music.
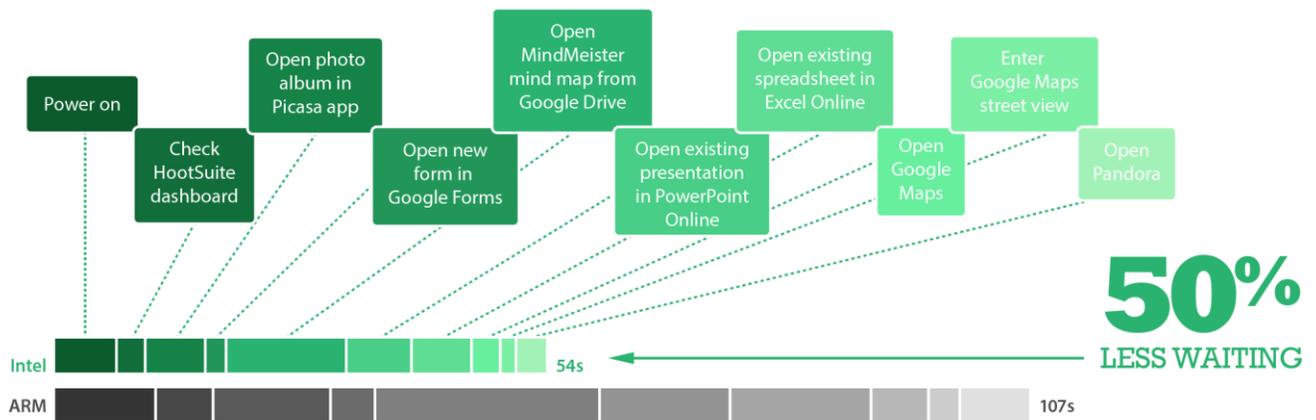
Planning a business event

Figure 3: The amount of time spent waiting by the two Chromebooks in 10 tasks while planning a business event.

> Carlos would have to wait 11 extra seconds to open a brainstorming mind map on the ARM processor-based Chromebook.

As Figure 3 shows, the Intel processor-powered Chromebook moved through the workflow with 50 percent less waiting than the ARM processor-based Chromebook. With the Intel processor-powered Chromebook, Carlos could be working on his event plan instead of waiting 11 extra seconds to open the brainstorming mind map or 8 extra seconds to open the PowerPoint presentation on the ARM processor-based model. He also wouldn't get frustrated waiting 6 extra seconds just to open a Picasa photo album or 8 extra seconds to open an Excel spreadsheet.

CRUNCHING THE NUMBERS

Leah gets to the office and turns on her Chromebook to prepare a weekly finance report. She opens the report template in Google Docs. She pulls up a report in Wave Accounting, and compares it to an Excel spreadsheet that a team member sent to her at close of business the previous day. After converting the spreadsheet to Google Sheets format, she does some quick calculations and sorting. Leah has some questions about the spreadsheet, so she hops on a Google Hangouts call with a colleague and shares her Google Sheets spreadsheet in the call to review the numbers together. After the call, she opens Google Keep to jot down some action items. She updates the data in Google Sheets and converts it into an Excel spreadsheet to send back to her colleague.

Leah moves on to her next task, logging into a shared system running Windows® to access QuickBooks®.
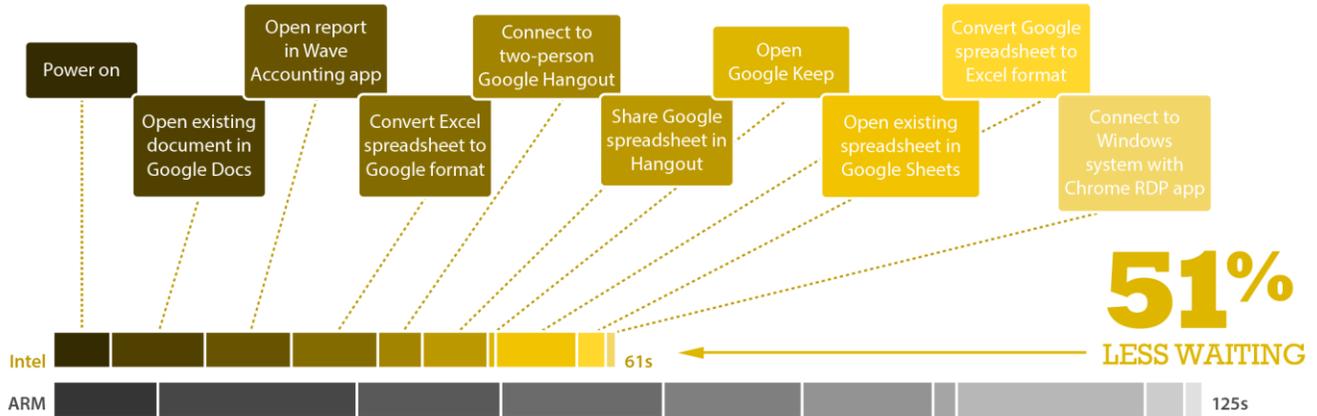
Crunching the numbers

Figure 4: The amount of time spent waiting by the two Chromebooks in 10 tasks while crunching the numbers.

> Opening the Google Docs report template on the Intel processor-powered Chromebook would save Leah over 11 valuable seconds.

As Figure 4 shows, the Intel processor-powered Chromebook moved through the workflow with 51 percent less waiting than the ARM processor-based Chromebook. If Leah were using the Intel processor-powered Chromebook, she wouldn't have to wait over 11 extra seconds to open the Google Docs report template or 10 extra seconds to start a new Google Hangouts call. Each app she would use to create the weekly finance report—Google Docs, Wave Accounting, Google Sheets, Google Keep—would take less time to open on the Intel processor-powered Chromebook.

BUILDING A MARKETING PLAN

Caleb sits down with his team to discuss ideas for that quarter's marketing programs and turns on his Chromebook. He opens the MindMeister project plan mind map for the previous quarter to reference in their conversation. He also opens a new Word document in Word Online to jot down notes for their proposal. After the meeting, a colleague calls him in Google Hangouts to discuss a potential project in the marketing campaign. Caleb adds a PowerPoint presentation to the call after joining, and they go over the proposal together. He works on the proposal in PowerPoint Online after the call, and then heads to a meeting with management. He presents the proposal on a TV using Chromecast. After the meeting, Caleb returns to his office and opens his Harvest timesheet to catch up on his hours.
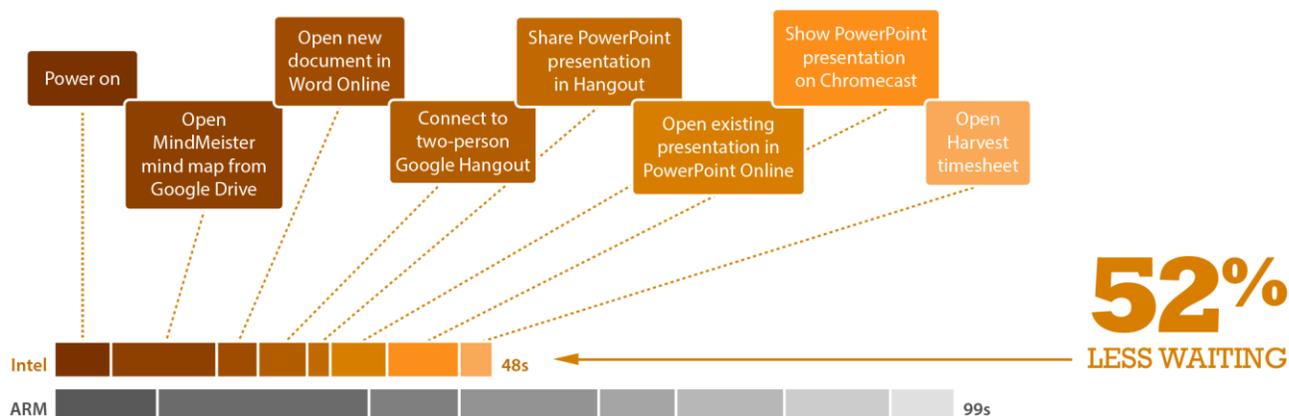
Building a marketing plan

Figure 5: The amount of time spent waiting by the two Chromebooks in eight tasks while building a marketing plan.

> Caleb would lose over 10 seconds when connecting to a Google Hangouts call on the ARM processor-based Chromebook.

As Figure 5 shows, the Intel processor-powered Chromebook moved through the workflow with 52 percent less waiting than the ARM processor-based Chromebook. With the Intel processor-powered Chromebook, Caleb would save over 10 seconds when joining the Google Hangouts call and over 5 seconds when sharing his PowerPoint presentation in the call. Even simple tasks would take longer on the ARM processor-based Chromebook—Caleb would have to wait almost 6 extra seconds just to open a new Word document in Word Online and over 5 extra seconds to open a presentation in PowerPoint Online.

THE BOTTOM LINE

Which Chromebook is the better choice for small business owners and their staff? We put two similar Chromebook models to the test, and found that the Intel processor-powered Chromebook moved through the four workflows with significantly less waiting than the ARM processor-based model. The Intel processor-powered Chromebook also lasted significantly longer without a charge while browsing the Internet.

When looking at Chromebooks, small businesses want devices that help their employees get work done instead of getting in the way of that work. With the Intel processor-powered Chromebook, employees can spend less time waiting, start working sooner, and work longer on a single charge than with the ARM-based model.

APPENDIX A: DETAILED SYSTEM CONFIGURATION

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

System	Intel processor-powered Chromebook	ARM processor-based Chromebook
Vendor and model	Acer® C720 Chromebook	Samsung® Chromebook
Processor	Intel Celeron® Processor 2955U (Haswell microarchitecture)	Samsung Exynos 5 Dual
Processor frequency (GHz)	1.4	1.7
Processor cores	2	2
Memory	2GB DDR3L SDRAM	2GB DDR3L SDRAM
Storage	16GB SSD	16GB SSD
Battery type	3-cell Li-Polymer	2 cell Li-Polymer
Battery capacity	45 Wh	30 Wh
Display	11.6" (1,366 × 768)	11.6" (1,366 × 768)
Wireless	802.11 a/b/g/n	802.11 a/b/g/n
Bluetooth®	Bluetooth 4.0 compatible	Bluetooth 3.0 compatible
USB ports	1 × USB 3.0 1 × USB 2.0	1 × USB 3.0 1 × USB 2.0
System weight	2.76 lbs.	2.42 lbs.
OS	Chrome OS™ version 32.0.1700.103	Chrome OS version 32.0.1700.103
Firmware	Google_Peppy.4389.81.0	Google_Snow.2695.117.0

Figure 6: Detailed configuration information for the two Chromebooks.

APPENDIX B: DETAILED TEST METHODOLOGY

To simulate collaboration in Google Hangouts, we set up a test environment with one Windows client signed into Google Hangouts. We also set both Chromebook systems to sign into Google Hangouts when Chrome starts.

To simulate a remote desktop session, we set up a test environment with a desktop system running Windows 8. We used the third-party Chrome RDP client to access the remote desktop system.

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 to 70 nits as possible.
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. Repeat steps 1 through 5 two more times.

Drafting a business proposal

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 Google Keep from the apps list.
5. When Google Keep is fully displayed, stop the timer, and record the result.
6. Simultaneously start the timer and open Google Docs from the shelf to open a new document.
7. When the document is fully displayed, stop the timer, and record the result.
8. Simultaneously start the timer and open Google Drive from the Google Docs menu.
9. Open the existing PowerPoint presentation.
10. Select Open to view the PowerPoint presentation in Google Drive Viewer.
11. When the presentation is fully displayed, stop the timer, and record the result.
12. Close the Google Docs document, and close Google Drive.
13. Press Ctrl+T to open a new Chrome tab.
14. Type `amazon.com`.
15. Simultaneously start the timer and press Enter to open Amazon.com.
16. When Amazon.com is fully displayed, stop the timer, and record the result.

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17. On the first Windows client, start a new Google Hangouts call and invite the test system.
18. On the test system, simultaneously start the timer and select Answer to join the call.
19. When the call is fully connected, stop the timer, and record the result.
20. Open Google Drive from within the Google Hangouts call.
21. Select the checkbox next to the Google Docs document.
22. Simultaneously start the timer and select Share to add the Google Docs document to the call.
23. Select to give access to the Google Docs document.
24. When the document is fully displayed, stop the timer, and record the result.
25. Remove the Google Docs document from the call, and leave the call.
26. Select the tab for the PowerPoint presentation.
27. Simultaneously start the timer and open Google Drive from the Google Drive Viewer menu.
28. Open the existing Google Docs document.
29. When the document is fully displayed, stop the timer, and record the result.
30. Close the Google Docs document.
31. Select the checkbox next to the Google Docs document.
32. Select the More drop-down menu, and then select Download.
33. Choose Microsoft® Word format.
34. Simultaneously start the timer and select Download to convert the Google Docs document to Word format.
35. When the Word document has fully downloaded, stop the timer, and record the result.
36. Press Ctrl+T to open a new Chrome tab.
37. Simultaneously start the timer and click on the bookmark for SugarCRM.
38. When SugarCRM is fully displayed, stop the timer, and record the result.
39. Simultaneously start the timer and select Opportunities.
40. When the dashboard is fully displayed, stop the timer, and record the result.
41. Simultaneously start the timer and open the Harvest app from the apps list.
42. Open the Harvest timesheet.
43. When the Harvest timesheet is fully displayed, stop the timer, and record the result.
44. Repeat steps 1 through 43 two more times.

Planning a business event
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 the HootSuite app from the apps list.
5. When the dashboard is fully displayed, stop the timer, and record the result.
6. Simultaneously start the timer and open the Picasa app from the apps list.
7. Select the photo album.
8. When the photo album is fully displayed, stop the timer, and record the result.
9. Simultaneously start the timer and open Google Forms from the apps list to open a new form.
10. When the form is fully displayed, stop the timer, and record the result.
11. Close Google Forms.
12. Simultaneously start the timer and open Google Drive from the apps list.

13. Open the MindMeister brainstorming mind map.
14. Choose to open the mind map with the MindMeister app.
15. When the mind map is fully displayed, stop the timer, and record the result.
16. Press Ctrl+T to open a new Chrome tab.
17. Type `login.microsoftonline.com`, and press Enter.
18. Enter username and password for the account, and press Enter to sign into the account.
19. In the menu, select the SkyDrive® link.[1]
20. Right-click the link for the existing PowerPoint presentation.
21. Simultaneously start the timer and open the existing PowerPoint presentation in a new tab.
22. Select the tab for the PowerPoint presentation.
23. Select to edit the PowerPoint presentation in PowerPoint Online.
24. When the presentation is fully displayed, stop the timer, and record the result.
25. Select the tab for SkyDrive.
26. Right-click the link for the existing Excel spreadsheet.
27. Simultaneously start the timer and open the existing Excel spreadsheet in a new tab.
28. Select the tab for the Excel spreadsheet.
29. Select to edit the Excel spreadsheet in Excel Online.
30. When the spreadsheet is fully displayed, stop the timer, and record the result.
31. Simultaneously start the timer and open Google Maps from the apps list.
32. When Google Maps is fully displayed, stop the timer, and record the result.
33. Type `Raleigh Convention Center` and press Enter.
34. Drag the yellow pegman to Salisbury Street.
35. Simultaneously start the timer and release the pegman to enter Street View.
36. When Street View is fully displayed, stop the timer, and record the result.
37. Press Ctrl+T to open a new Chrome tab.
38. Type `pandora.com`.
39. Simultaneously start the timer and press Enter to open Pandora.
40. When Pandora is fully displayed, stop the timer, and record the result.
41. Repeat steps 1 through 40 two more times.

Crunching the numbers
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 Google Drive from the apps list.
5. Open the existing Google Docs document.
6. When the document is fully displayed, stop the timer, and record the result.
7. Simultaneously start the timer and open the Wave Accounting app from the apps list.
8. Select Reports.

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[1] SkyDrive and SkyDrive Pro will soon become OneDrive and OneDrive for Business, respectively.

9. Select Balance Sheet.
10. When the balance sheet report is fully displayed, stop the timer, and record the result.
11. Select the tab for Google Drive.
12. Select the checkbox next to the Excel spreadsheet.
13. Select the More drop-down menu.
14. Simultaneously start the timer and open with Google Sheets to convert the Excel spreadsheet to Google Sheets format.
15. When the spreadsheet is fully displayed, stop the timer, and record the result.
16. Close the Google Sheets spreadsheet, and close Google Drive.
17. Simultaneously start the timer and open Hangouts call from the apps list.
18. When the invite screen is fully displayed, stop the timer, and record the result.
19. Enter the Google account username for the first Windows client, and send an invite to that Windows client.
20. On the Windows client, answer the Google Hangouts call.
21. On the test system, open Google Drive from within the Google Hangouts call.
22. Select the checkbox next to the Google Sheets spreadsheet.
23. Simultaneously start the timer and select Share to add the Google Sheets spreadsheet to the call.
24. Select to give access to the Google Sheets spreadsheet.
25. When the spreadsheet is fully displayed, stop the timer, and record the result.
26. Remove the Google Sheets spreadsheet from the call, and leave the call.
27. Simultaneously start the timer and open Google Keep from the apps list.
28. When Google Keep is fully displayed, stop the timer, and record the result.
29. Select the tab for the Google Docs document.
30. Simultaneously start the timer and open Google Drive from the Google Docs menu.
31. Open the existing Google Sheets spreadsheet.
32. When the spreadsheet is fully displayed, stop the timer, and record the result.
33. Close the Google Sheets spreadsheet.
34. Select the checkbox next to the Google Sheets spreadsheet.
35. Select the More drop-down menu, and then select Download.
36. Choose Microsoft Excel format.
37. Simultaneously start the timer and select Download to convert the Google Sheets spreadsheet to Excel format.
38. When the Excel spreadsheet has fully downloaded, stop the timer, and record the result.
39. Open the Chrome RDP app from the apps list.
40. Enter the IP address for the Windows desktop system.
41. Enter the username and password.
42. Simultaneously start the timer and select OK.
43. When the Windows desktop is fully displayed, stop the timer, and record the result.
44. Repeat steps 1 through 43 two more times.

Building a marketing plan

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 Google Drive from the apps list.
5. Open the MindMeister project plan mind map.
6. Choose to open the mind map with the MindMeister app.
7. When the mind map is fully displayed, stop the timer, and record the result.
8. Press Ctrl+T to open a new Chrome tab.
9. Type `login.microsoftonline.com`, and press Enter.
10. Enter username and password for the account, and press Enter to sign into the account.
11. Select the SkyDrive link in the menu.
12. Select the plus sign, and select to create a new Word document.
13. Enter a name for the new Word document.
14. Simultaneously start the timer and press Enter to open the new Word document.
15. When the document is fully displayed, stop the timer, and record the result.
16. On the first Windows client, start a new Google Hangouts call and invite the test system.
17. On the test system, simultaneously start the timer and select Answer to join the call.
18. When the call is fully connected, stop the timer, and record the result.
19. Open Google Drive from within the Google Hangouts call.
20. Select the PowerPoint presentation.
21. Simultaneously start the timer and select Share to add the PowerPoint presentation to the call.
22. Select to edit the PowerPoint presentation in PowerPoint Online.
23. When the presentation is fully displayed, stop the timer, and record the result.
24. Remove the PowerPoint presentation from the call, and leave the call.
25. Press Ctrl+T to open a new Chrome tab.
26. Type `login.microsoftonline.com`, and press Enter.
27. Select the SkyDrive link in the menu.
28. Simultaneously start the timer and open the existing PowerPoint presentation.
29. Select to edit the PowerPoint presentation in PowerPoint Online.
30. When the presentation is fully displayed, stop the timer, and record the result.
31. Open the Google Cast extension.
32. Simultaneously start the timer and select the Chromecast device.
33. When the presentation is fully displayed on the TV, stop the timer, and record the result.
34. Open the Google Cast extension, and select to stop casting.
35. Simultaneously start the timer and open the Harvest app from the apps list.
36. Open the Harvest timesheet.
37. When the Harvest timesheet is fully displayed, stop the timer, and record the result.
38. Repeat steps 1 through 37 two more times.

APPENDIX C: DETAILED RESULTS

Figure 7 presents the detailed results for the two Chromebooks, with battery life while browsing recorded in hours and the time to complete tasks in the workflows in seconds. We performed each tasks three times and used the median scores.

	Intel processor-powered Chromebook	ARM processor-based Chromebook
Battery life while browsing		
Battery life while lightly browsing the Internet (higher is better)		
Run 1	10:49:00.00	06:55:00.00
Run 2	11:04:00.00	07:03:00.00
Run 3	11:08:00.00	07:01:00.00
Median	**11:04:00.00**	**07:01:00.00**
Drafting a business proposal		
Time to turn on system (lower is better)		
Run 1	00:06.50	00:11.10
Run 2	00:06.50	00:11.50
Run 3	00:06.60	00:11.40
Median	**00:06.50**	**00:11.40**
Time to open Google Keep (lower is better)		
Run 1	00:01.10	00:02.90
Run 2	00:00.90	00:02.60
Run 3	00:00.90	00:02.70
Median	**00:00.90**	**00:02.70**
Time to open new document in Google Docs (lower is better)		
Run 1	00:03.80	00:08.00
Run 2	00:03.70	00:08.20
Run 3	00:03.60	00:08.00
Median	**00:03.70**	**00:08.00**
Time to open PowerPoint presentation in Google Drive Viewer (lower is better)		
Run 1	00:07.10	00:15.00
Run 2	00:07.10	00:15.10
Run 3	00:07.20	00:15.50
Median	**00:07.10**	**00:15.10**
Time to open Amazon.com (lower is better)		
Run 1	00:01.90	00:04.40
Run 2	00:02.00	00:04.90
Run 3	00:02.00	00:04.70
Median	**00:02.00**	**00:04.70**
Time to connect to Google Hangouts call with one other participant (lower is better)		
Run 1	00:06.20	00:15.20
Run 2	00:06.20	00:15.30
Run 3	00:05.90	00:15.60
Median	**00:06.20**	**00:15.30**
Time to share Google Docs document in Google Hangouts call (lower is better)		
Run 1	00:08.40	00:17.00
Run 2	00:08.00	00:17.30
Run 3	00:07.90	00:16.80
Median	**00:08.00**	**00:17.00**

	Intel processor-powered Chromebook	ARM processor-based Chromebook
Time to open existing document in Google Docs (lower is better)		
Run 1	00:10.80	00:20.40
Run 2	00:10.50	00:21.00
Run 3	00:10.30	00:21.10
Median	**00:10.50**	**00:21.00**
Time to convert Google Docs document to Word format (lower is better)		
Run 1	00:02.50	00:03.60
Run 2	00:02.40	00:03.80
Run 3	00:02.60	00:03.80
Median	**00:02.50**	**00:03.80**
Time to open SugarCRM (lower is better)		
Run 1	00:10.80	00:18.90
Run 2	00:10.10	00:18.40
Run 3	00:10.40	00:18.40
Median	**00:10.40**	**00:18.40**
Time to open SugarCRM opportunities dashboard (lower is better)		
Run 1	00:05.20	00:09.00
Run 2	00:05.40	00:09.20
Run 3	00:05.20	00:08.90
Median	**00:05.20**	**00:09.00**
Time to open Harvest timesheets (lower is better)		
Run 1	00:03.80	00:06.70
Run 2	00:03.80	00:06.80
Run 3	00:03.60	00:06.90
Median	**00:03.80**	**00:06.80**
Total time waiting	**01:06.80**	**02:13.20**
Planning a business event		
Time to turn on system (lower is better)		
Run 1	00:06.50	00:11.10
Run 2	00:06.50	00:11.30
Run 3	00:06.40	00:11.10
Median	**00:06.50**	**00:11.10**
Time to check HootSuite dashboard (lower is better)		
Run 1	00:03.00	00:06.40
Run 2	00:03.20	00:06.70
Run 3	00:03.40	00:06.30
Median	**00:03.20**	**00:06.40**
Time to open photo album in Picasa app (lower is better)		
Run 1	00:06.60	00:12.90
Run 2	00:06.80	00:13.40
Run 3	00:06.40	00:12.80
Median	**00:06.60**	**00:12.90**

	Intel processor-powered Chromebook	ARM processor-based Chromebook
Time to open new form in Google Forms (lower is better)		
Run 1	00:02.40	00:05.10
Run 2	00:02.20	00:04.90
Run 3	00:02.20	00:04.70
Median	**00:02.20**	**00:04.90**
Time to open MindMeister brainstorming mind map from Google Drive (lower is better)		
Run 1	00:13.20	00:23.90
Run 2	00:13.50	00:24.40
Run 3	00:13.10	00:24.50
Median	**00:13.20**	**00:24.40**
Time to open existing presentation in PowerPoint Online (lower is better)		
Run 1	00:07.20	00:14.70
Run 2	00:06.90	00:14.40
Run 3	00:06.70	00:14.00
Median	**00:06.90**	**00:14.40**
Time to open existing spreadsheet in Excel Online (lower is better)		
Run 1	00:07.10	00:14.70
Run 2	00:06.80	00:15.00
Run 3	00:06.70	00:15.40
Median	**00:06.80**	**00:15.00**
Time to open Google Maps (lower is better)		
Run 1	00:03.30	00:06.30
Run 2	00:03.10	00:06.70
Run 3	00:03.10	00:06.10
Median	**00:03.10**	**00:06.30**
Time to enter Google Maps Street View (lower is better)		
Run 1	00:01.80	00:03.60
Run 2	00:02.20	00:03.60
Run 3	00:01.70	00:03.50
Median	**00:01.80**	**00:03.60**
Time to open Pandora (lower is better)		
Run 1	00:03.60	00:07.70
Run 2	00:03.50	00:07.70
Run 3	00:03.30	00:07.50
Median	**00:03.50**	**00:07.70**
Total time waiting	**00:53.80**	**01:46.70**
Crunching the numbers		
Time to turn on system (lower is better)		
Run 1	00:06.40	00:11.30
Run 2	00:06.40	00:11.10
Run 3	00:06.60	00:11.40
Median	**00:06.40**	**00:11.30**
Time to open existing document in Google Docs (lower is better)		
Run 1	00:10.80	00:21.70
Run 2	00:10.40	00:21.60
Run 3	00:10.40	00:21.90
Median	**00:10.40**	**00:21.70**

	Intel processor-powered Chromebook	ARM processor-based Chromebook
Time to open report in Wave Accounting app (lower is better)		
Run 1	00:09.60	00:15.90
Run 2	00:09.10	00:15.80
Run 3	00:09.20	00:15.40
Median	**00:09.20**	**00:15.80**
Time to convert Excel spreadsheet to Google Sheets format (lower is better)		
Run 1	00:09.40	00:17.50
Run 2	00:09.40	00:17.70
Run 3	00:09.50	00:17.20
Median	**00:09.40**	**00:17.50**
Time to start new Google Hangouts call with one other participants (lower is better)		
Run 1	00:04.80	00:15.30
Run 2	00:04.80	00:15.50
Run 3	00:05.00	00:15.40
Median	**00:04.80**	**00:15.40**
Time to share Google Sheets spreadsheets in Google Hangouts call (lower is better)		
Run 1	00:06.90	00:13.90
Run 2	00:07.00	00:14.10
Run 3	00:06.80	00:13.70
Median	**00:06.90**	**00:13.90**
Time to open Google Keep (lower is better)		
Run 1	00:01.00	00:03.10
Run 2	00:00.90	00:02.70
Run 3	00:01.00	00:02.60
Median	**00:01.00**	**00:02.70**
Time to open existing spreadsheet in Google Sheets (lower is better)		
Run 1	00:08.90	00:20.30
Run 2	00:08.70	00:20.40
Run 3	00:09.00	00:20.50
Median	**00:08.90**	**00:20.40**
Time to convert Google Sheets spreadsheet to Excel format (lower is better)		
Run 1	00:03.20	00:03.90
Run 2	00:03.20	00:04.30
Run 3	00:03.30	00:04.30
Median	**00:03.20**	**00:04.30**
Time to connect to shared Windows system using Chrome RDP client (lower is better)		
Run 1	00:01.20	00:01.90
Run 2	00:01.40	00:02.00
Run 3	00:01.10	00:01.80
Median	**00:01.20**	**00:01.90**
Total time waiting	**01:01.40**	**02:04.90**

	Intel processor-powered Chromebook	ARM processor-based Chromebook
Building a marketing plan		
Time to turn on system (lower is better)		
Run 1	00:06.40	00:11.40
Run 2	00:06.30	00:11.50
Run 3	00:06.60	00:11.40
Median	**00:06.40**	**00:11.40**
Time to open MindMeister project plan mind map from Google Drive (lower is better)		
Run 1	00:12.20	00:23.10
Run 2	00:11.90	00:23.20
Run 3	00:11.90	00:23.40
Median	**00:11.90**	**00:23.20**
Time to open new document in Word Online (lower is better)		
Run 1	00:04.40	00:10.20
Run 2	00:04.20	00:10.20
Run 3	00:04.60	00:09.80
Median	**00:04.40**	**00:10.20**
Time to connect to Google Hangouts call with one other participant (lower is better)		
Run 1	00:05.00	00:15.60
Run 2	00:05.30	00:15.20
Run 3	00:04.90	00:15.60
Median	**00:05.00**	**00:15.60**
Time to share PowerPoint presentation in Google Hangouts call (lower is better)		
Run 1	00:03.30	00:08.40
Run 2	00:02.90	00:08.60
Run 3	00:02.90	00:08.10
Median	**00:02.90**	**00:08.40**
Time to open existing presentation in PowerPoint Online (lower is better)		
Run 1	00:06.10	00:11.80
Run 2	00:06.00	00:11.70
Run 3	00:06.20	00:11.40
Median	**00:06.10**	**00:11.70**
Time to show PowerPoint presentation on Chromecast (lower is better)		
Run 1	00:08.70	00:12.00
Run 2	00:08.10	00:12.30
Run 3	00:08.00	00:11.60
Median	**00:08.10**	**00:12.00**
Time to open Harvest timesheet (lower is better)		
Run 1	00:03.60	00:06.90
Run 2	00:03.40	00:06.80
Run 3	00:03.70	00:07.00
Median	**00:03.60**	**00:06.90**
Total time waiting	**00:48.40**	**01:39.40**

Figure 7: Detailed results. We report battery life while browsing in hours and the time to complete tasks in the workflows in seconds.

ABOUT PRINCIPLED TECHNOLOGIES

![Principled Technologies® logo]

Principled Technologies, Inc.
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We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

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Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.