

# Spend less time *waiting*, more time *working* with the Intel®-powered Chromebook™



**58%** longer battery life  
*while Web browsing*

**51%** less waiting to create  
*a sales proposal*

**59%** less waiting to manage  
*a marketing plan*

**51%** less waiting to deliver  
*a fiscal report*

**52%** less waiting to plan  
*a corporate event*

compared to the ARM®-based model in every workflow we tested

Today's enterprise employees are busy. They have deadlines they can't miss, performance objectives to meet, multiple projects to manage, and sales numbers to reach. If the device they use takes too long to load apps or documents, they waste valuable time as they wait to begin working on a report or start collaborating with colleagues, becoming frustrated and losing productivity. They want to pick up their device, get going right away, and move from one task to another quickly and easily. Enterprises want this, too—the less time their employees spend waiting on their devices, the sooner they can start working and the more productive they can be.

If a company decides to implement Chromebooks for their employees, which model is the best choice? We put an Intel processor-powered Chromebook and an ARM processor-based Chromebook through enterprise employee workflows that included regularly performed tasks such as collaborating in calls 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.

The bottom line? We found that the Intel processor-powered Chromebook powered through our tests, moving through the four employee workflows with up to 59 percent less waiting than the ARM processor-based Chromebook model. It also lasted 58 percent longer on a single charge while browsing the Web. With the Intel processor-powered Chromebook, enterprise employees can spend less time waiting and more time working.



## LESS WAITING WITH THE RIGHT CHROMEBOOK

Enterprises looking to implement Chromebooks have many choices as more Chromebook models enter the market. We looked at two available Chromebooks, one with an Intel processor and one with an ARM processor, putting them through representative workflows with tasks that enterprise employees would perform regularly during the workday. We also looked at how long each system could keep going on a single charge while lightly browsing the Internet. For more on how we tested, see [Appendix B](#). For detailed results, see [Appendix C](#).

We chose two systems that were as similar as possible, with the same display size and the same amount of memory and storage. In addition to the difference in processor, they differ in battery size, as the Intel processor-powered Chromebook has a 3-cell rather than a 2-cell battery. For more on the representative systems, see [Appendix A](#).

## BATTERY LIFE WHILE BROWSING

Battery life is important as today's workforce is always on the go—who wants to worry about their system running out of juice during a meeting or presentation? We found that the Intel processor-powered Chromebook lasted 58 percent longer than the ARM processor-based Chromebook while lightly browsing the Internet—an additional 4 hours and 3 minutes on a single charge (see Figure 1).



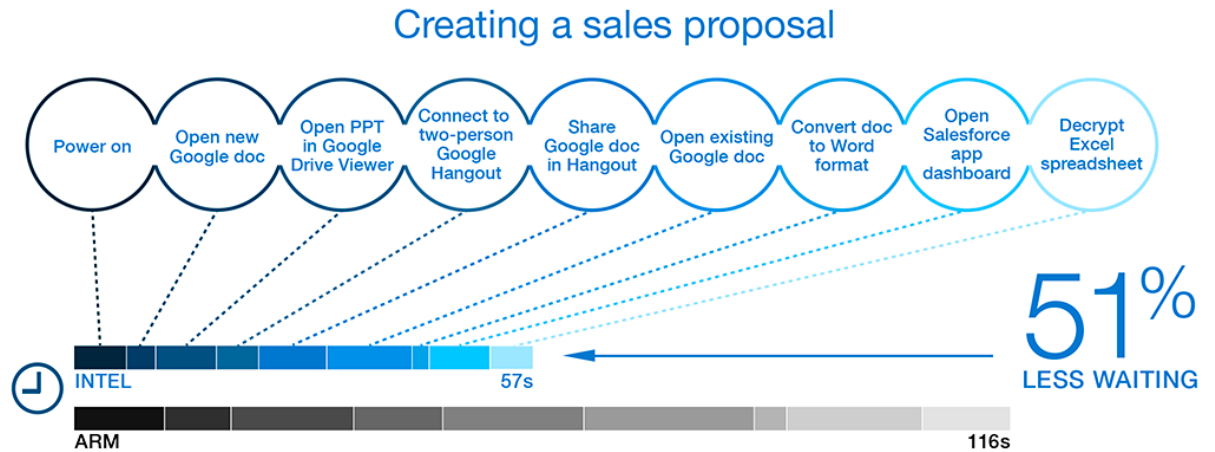
**58% longer battery life**

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

## CREATING A SALES PROPOSAL

Kieren opens her Chromebook and powers it on at the beginning of the workday. She opens a new document in Google® Docs to draft a proposal for a potential engagement with a client. While working on the document, she looks at a PowerPoint®

presentation in Google Drive™ Viewer that the client sent to her the previous evening. She checks her calendar, and continues working until a Google Hangouts™ call with her manager. After calling her manager, Kieren shares the proposal in the call so that they can review it together. She incorporates her manager’s feedback following the call, and saves the Google Docs document as a Word® document to send to the client. She opens the Salesforce.com app to update data about the opportunity, and then moves on to an encrypted Excel® spreadsheet to review action items from the last team meeting.



**Figure 2: The amount of time spent waiting with the two Chromebooks in nine tasks while creating a sales proposal.**

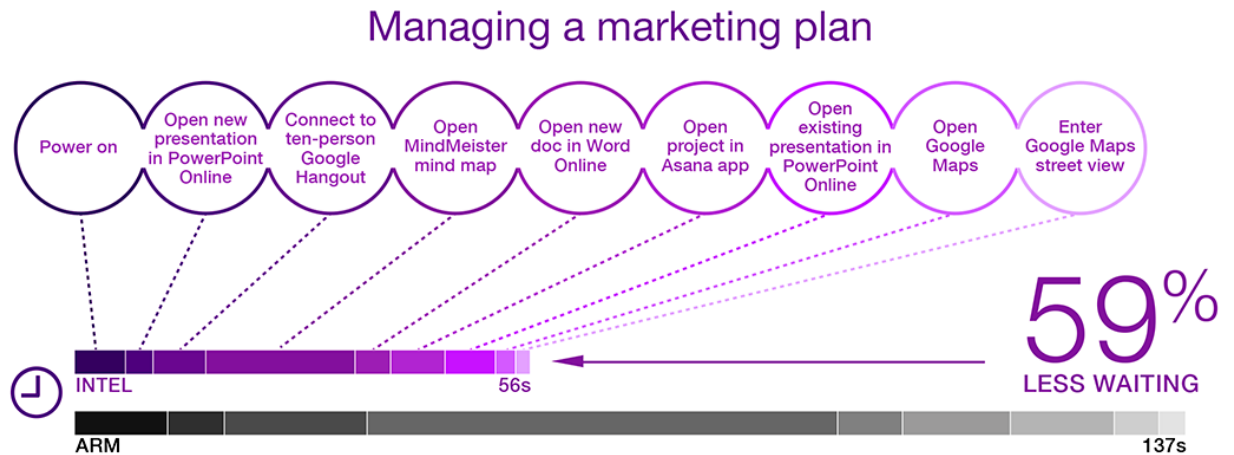
With the ARM processor-based Chromebook, Kieren would have to wait over 10 extra seconds to open a document.

As Figure 2 shows, the Intel processor-powered Chromebook moved through the workflow with 51 percent less waiting than the ARM processor-based Chromebook. If Kieren were using the Intel processor-powered Chromebook, she would spend less than half the time waiting on her Chromebook. Instead of spending extra time waiting for the system to share her proposal in the Google Hangouts call, Kieren could be going over it with her manager. With the Intel processor-powered Chromebook, she wouldn’t have to lose time and wait 9 extra seconds to load the Salesforce.com dashboard or 11 extra seconds to open the spreadsheet.

## MANAGING A MARKETING PLAN

Gabriel powers on his Chromebook and gets to work on a new presentation in PowerPoint Online for a business development proposal. After working on the presentation for a while, he heads to a team meeting to discuss ideas for that quarter’s rolling thunder marketing efforts. Gabriel answers a Google Hangouts call to join a meeting with nine other participants calling in from other regions. He opens his MindMeister project plan mind map for the previous fiscal year to guide his team’s

discussion. After the meeting, he opens a new document in Word Online to jot down notes from the call. He opens a project in the Asana app to add the action items from the meeting, and then gets back to work on the presentation in PowerPoint Online. Gabriel then checks Google Maps™ to confirm the location of a dinner meeting with a potential business partner.



**Figure 3: The amount of time spent waiting with the two Chromebooks in nine tasks while managing a marketing plan.**

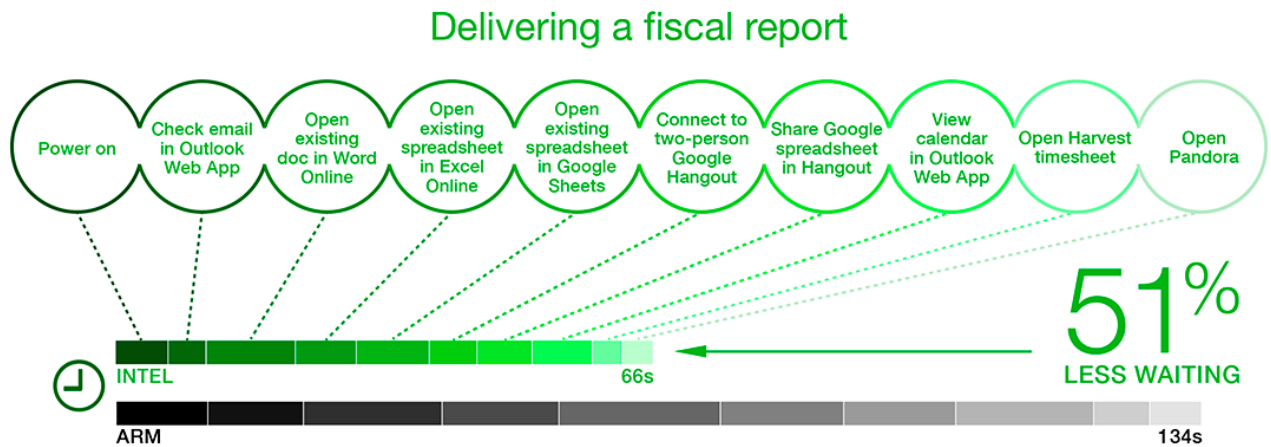
Gabriel would have to wait 11 seconds longer to connect to a large Google Hangouts call on the ARM processor-based Chromebook.

As Figure 3 shows, the Intel processor-powered Chromebook moved through the workflow with 59 percent less waiting than the ARM processor-based Chromebook. With the Intel processor-powered Chromebook, Gabriel could be more productive by collaborating with his colleagues instead of waiting 11 extra seconds to connect to the Google Hangouts call on the ARM processor-based model. He also wouldn't get frustrated waiting three times as long for the MindMeister project plan mind map to open while he was on the call.

## DELIVERING A FISCAL REPORT

Beverly gets to the office and turns on her Chromebook. She checks her email and sees a message from her manager requesting an updated copy of the department's fiscal report. She opens the Word document template to work on the report in Word Online. She also pulls up a large Excel spreadsheet in Excel Online and compares it to a Google Sheets spreadsheet that a team member sent to her at close of business the previous day. She answers a scheduled Google Hangouts call from her team member to go over the numbers. She has some questions about the data in the Google Sheets spreadsheet, and adds the spreadsheet to the Google Hangouts call so they can review it together. After finishing the report, Beverly checks her calendar for the afternoon, and

then opens her Harvest timesheet to catch up on hours. She opens Pandora® to listen to music while she works on her timesheet.



**Figure 4: The amount of time spent waiting with the two Chromebooks in ten tasks while delivering a fiscal report.**

Beverly would save almost 10 seconds when checking her calendar on the Intel processor-powered Chromebook.

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 Beverly were using the Intel processor-powered Chromebook, she wouldn't have to wait 7 extra seconds when checking for new email messages or almost 10 extra seconds to check her calendar. Each app she uses to create the fiscal report for her manager—Google Sheets, Excel Online, Google Hangouts—would take less time to open on the Intel processor-powered Chromebook, saving her valuable time in the middle of a busy day.

## PLANNING A CORPORATE EVENT

Ian powers on his Chromebook to work remotely from home. He opens his HootSuite™ dashboard to check recent social media activity and to make a couple posts. To draft a proposal for the next event, he opens a MindMeister brainstorming mind map that he has been working on the past couple days and a new presentation in Google Slides. He finishes a draft of the presentation just before a scheduled Google Hangouts call with colleagues in several different countries, and connects to the call with nine other participants. Ian shares his presentation in the Google Hangouts call so they can go over it together. Ian opens Google Keep™ to jot down some action items from the meeting. He continues to revise the presentation, and logs into his Citrix® virtual desktop to use a Windows®-based application not available on his Chromebook. When

he finishes with the Google Slides presentation, Ian converts it to a PowerPoint presentation before sending it to a business partner.

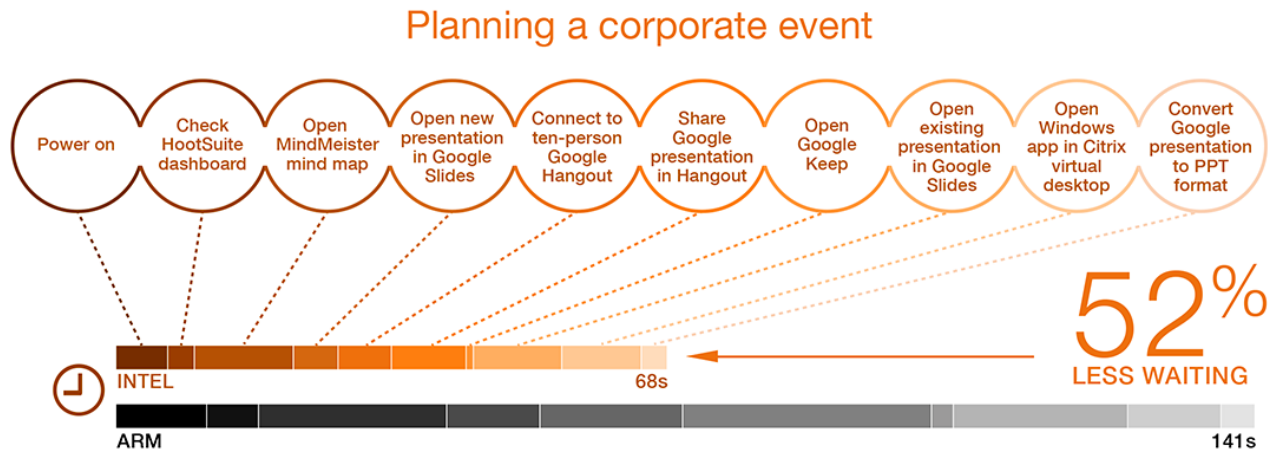


Figure 5: The amount of time spent waiting with the two Chromebooks in ten tasks while planning a corporate event.

Ian would have to wait an extra 21 seconds to share his presentation in 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. Ian would save over 33 seconds when joining the large Google Hangouts call and sharing his Google Slides presentation in the call on his Intel processor-powered Chromebook. On the ARM processor-based model, Ian would lose 11 seconds when opening his MindMeister brainstorming mind map and over 10 seconds when opening his presentation after the call—time he could be using to get work done on the Intel processor-powered Chromebook.

## THE BOTTOM LINE

Which model is the best for enterprises and their employees? The longer employees must wait for a Chromebook to open apps or documents, the less productive they become and the more energy they spend getting distracted and frustrated instead of working. We put two similar Chromebook models to the test, and found that the Intel processor-powered Chromebook moved through the enterprise employee workflows with significantly less waiting than the ARM processor-based model, while also lasting significantly longer without a charge while lightly browsing the Internet.

The forecast is clear: With the Intel processor-powered Chromebook, enterprise employees can get working sooner, waste less time waiting, and can work longer without a charge. The Intel processor-powered Chromebook is the better choice for enterprise employees over the ARM-based Chromebook.

## APPENDIX A: DETAILED SYSTEM CONFIGURATION

Figure 6 presents detailed information on 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 group collaboration in Google Hangouts, we set up a test environment with nine Windows clients signed into Google Hangouts. We also set both Chromebook systems to sign into Google Hangouts when Chrome starts.

To simulate a Citrix VDI virtual desktop session, we set up a test environment with a two-socket server to deliver Windows 7 desktops using Citrix StoreFront 2.1 and the Citrix Receiver™ for HTML5 client. We bookmarked the URL for easy access to the virtual desktop session on both systems.

### 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.

### Creating a sales 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 Docs from the shelf to open a new document.
5. When the document is fully displayed, stop the timer, and record the result.
6. Simultaneously start the timer and open Google Drive™ from the Google Docs menu.
7. Open the existing PowerPoint presentation.
8. Select Open to view the PowerPoint presentation in Google Drive Viewer.
9. When the presentation is fully displayed, stop the timer, and record the result.
10. Close the Google Docs document, and close Google Drive.
11. Simultaneously start the timer and open Hangouts call from the apps list.
12. When the invite screen is fully displayed, stop the timer, and record the result.
13. Enter the Google account username for the first Windows client, and send an invite to that Windows client.
14. On the Windows client, answer the Google Hangouts call.
15. On the test system, open Google Drive from within the Google Hangouts call.



16. Select the Google Docs document.
17. Simultaneously start the timer and select Share to add the Google Docs document to the call.
18. Select to give access to the Google Docs document.
19. When the document is fully displayed, stop the timer, and record the result.
20. Remove the Google Docs document from the call, and leave the call.
21. Select the PowerPoint presentation.
22. Simultaneously start the timer and open Google Drive from the Google Drive Viewer menu.
23. Open the existing Google Docs document.
24. When the document is fully displayed, stop the timer, and record the result.
25. Close the Google Docs document.
26. Select the Google Docs document in Google Drive.
27. Select the More drop-down menu, and select Download.
28. Choose Microsoft® Word format.
29. Simultaneously start the timer and select Download to convert the Google Docs document to Word format.
30. When the Word document has fully downloaded, stop the timer, and record the result.
31. Close Google Drive.
32. Simultaneously start the timer and open the Salesforce.com app from the apps list.
33. Enter the account password, and press Enter.
34. Select Opportunities.
35. When the dashboard is fully displayed, stop the timer, and record the result.
36. Close the PowerPoint presentation.
37. Open the Boxcryptor extension.
38. Enter email and password, and press Enter.
39. From the apps list, open Google Drive.
40. In Google Drive, select the Excel spreadsheet.
41. Select the More drop-down menu.
42. Simultaneously start the timer and select Download to decrypt the spreadsheet.
43. Stop the timer when the Save file as dialog appears.
44. Repeat steps 1 through 43 two more times.

## Managing 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. Open Google Chrome from the shelf.
5. Type `login.microsoftonline.com`, and press Enter.
6. Enter username and password for the account, and press Enter to sign into the account.
7. In the menu, select the SkyDrive® link.<sup>1</sup>
8. Select the plus sign, and open a new PowerPoint presentation.

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<sup>1</sup> SkyDrive and SkyDrive Pro will soon become OneDrive and OneDrive for Business, respectively.

9. Enter a name for the PowerPoint presentation.
10. Simultaneously start the timer and press Enter to open a new PowerPoint presentation.
11. When the presentation is fully displayed, stop the timer, and record the result.
12. Close the PowerPoint presentation.
13. On the first Windows client, start a new Google Hangouts call and invite the other eight Windows clients.
14. On the other eight Windows clients, answer the Google Hangouts call.
15. On the first Windows client, 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. Open Google Drive from the apps list.
19. Simultaneously start the timer and open the MindMeister project plan mind map.
20. Choose to open the mind map with the MindMeister app.
21. When the mind map is fully displayed, stop the timer, and record the result.
22. Close the MindMeister mind map, and leave the call.
23. To open a new Chrome tab, press Ctrl+T.
24. Type `login.microsoftonline.com`, and press Enter.
25. Enter username and password for the account.
26. In the menu, select the SkyDrive link.
27. Select the plus sign, and open a new Word document.
28. Enter a name for the Word document.
29. Simultaneously start the timer and press Enter to open a new Word document.
30. When the document is fully displayed, stop the timer, and record the result.
31. Simultaneously start the timer and open the Asana app from the apps list.
32. Open the Asana project.
33. When the project is fully displayed, stop the timer, and record the result.
34. Select the tab for the Word document.
35. Close the document through the File menu.
36. Simultaneously start the timer and open the existing PowerPoint presentation.
37. Select to edit the PowerPoint presentation in PowerPoint Online.
38. When the presentation is fully displayed, stop the timer, and record the result.
39. Simultaneously start the timer and open Google Maps from the apps list.
40. When Google Maps is fully displayed, stop the timer, and record the result.
41. Type `Moscone Center` and press Enter.
42. Drag the yellow pegman to Howard Street.
43. Simultaneously start the timer and release the pegman to enter Street View™.
44. When Street View is fully displayed, stop the timer, and record the result.
45. Repeat steps 1 through 44 two more times.

## Delivering a fiscal report

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. From the shelf, open Google Chrome.
5. Type `login.microsoftonline.com`, and press Enter.
6. Enter username and password for the account.
7. Simultaneously start the timer and press Enter to sign into the account.
8. When the email messages in the Outlook® Web App are fully displayed, stop the timer, and record the result.
9. Select the SkyDrive link in the menu.
10. Right-click the link to the existing Word document.
11. Simultaneously start the timer and open the Word document in a new tab.
12. Select the tab for the Word document.
13. Select to edit the Word document in Word Online.
14. When the document is fully displayed, stop the timer, and record the result.
15. Select the tab for SkyDrive.
16. Right-click the link to the existing Excel spreadsheet.
17. Simultaneously start the timer and open the existing Excel spreadsheet in a new tab.
18. Select the tab for the Excel spreadsheet.
19. Select to edit the Excel spreadsheet in Excel Online.
20. When the spreadsheet is fully displayed, stop the timer, and record the result.
21. Simultaneously start the timer and open Google Drive from the apps list.
22. Open the existing Google Sheets spreadsheet.
23. When the spreadsheet is fully displayed, stop the timer, and record the result.
24. Close the Google Sheets spreadsheet.
25. On the first Windows client, start a new Google Hangouts call and invite the test system.
26. On the test system, simultaneously start the timer and select Answer to join the call.
27. When the call is fully connected, stop the timer, and record the result.
28. From within the Google Hangouts call, open Google Drive.
29. Select the Google Sheets spreadsheet.
30. Simultaneously start the timer and select Share to add the Google Sheets spreadsheet to the call.
31. Select to give access to the spreadsheet.
32. When the spreadsheet is fully displayed, stop the timer, and record the result.
33. Remove the Google Sheets spreadsheet from the call, and leave the call.
34. Select the tab for the Word document.
35. Select the tab for SkyDrive.
36. Simultaneously start the timer and select the Calendar link in the menu.
37. When all appointments and meetings are fully displayed, stop the timer, and record the result.
38. Simultaneously start the timer and open the Harvest app from the apps list.
39. Open the Harvest timesheet.
40. When the Harvest timesheet is fully displayed, stop the timer, and record the result.
41. To open a new Chrome tab, press `Ctrl+T`.
42. Type `pandora.com`.
43. Simultaneously start the timer and press Enter to open Pandora.
44. When Pandora is fully displayed, stop the timer, and record the result.
45. Repeat steps 1 through 44 two more times.

## Planning a corporate 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 Google Drive from the apps list.
7. Open the MindMeister brainstorming mind map.
8. Choose to open the mind map with the MindMeister app.
9. When the mind map is fully displayed, stop the timer, and record the result.
10. Close Google Drive.
11. Simultaneously start the timer and open Google Slides from the shelf to open a new presentation.
12. When the Presentation choose a theme screen is fully displayed, stop the timer, and record the result.
13. Select the Simple Light theme.
14. Close the Google Slides presentation.
15. On the first Windows client, start a new Google Hangouts call and invite the other eight Windows clients.
16. On the other eight Windows clients, answer the Google Hangouts call.
17. On the first Windows client, send an invite to 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. From within the Google Hangouts call, open Google Drive.
21. Select the Google Slides presentation.
22. Simultaneously start the timer and select Share to add the Google Slides presentation to the call.
23. Select to give access to the Google Slides presentation.
24. When the presentation is fully displayed, stop the timer, and record the result.
25. Remove the Google Slides presentation from the call, and leave the call.
26. Simultaneously start the timer and open Google Keep from the apps list.
27. When Google Keep is fully displayed, stop the timer, and record the result.
28. Simultaneously start the timer and open Google Drive from the apps list.
29. Open the existing Google Slides presentation.
30. When the presentation is fully displayed, stop the timer, and record the result.
31. To open a new Chrome tab, press Ctrl+T.
32. Click on the bookmark for the Citrix VDI session.
33. Enter username and password.
34. Simultaneously start the timer and press Enter to log into the VDI session.
35. In the list of apps, open Paint.
36. When Paint is fully displayed, stop the timer, and record the result.
37. Open the tab for the Google Slides presentation.
38. Close the Google Slides presentation.
39. Select Google Drive, and select the Google Slides presentation.
40. Select the More drop-down menu, and then select Download.
41. Choose PowerPoint.

42. Simultaneously start the timer and select Download to convert the Google Slides presentation to PowerPoint format.
43. When the PowerPoint presentation has fully downloaded, stop the timer, and record the result.
44. Repeat steps 1 through 43 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
<b>Battery life while browsing</b>		
<b>Battery life while lightly browsing the Internet (higher is better)</b>		
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
<b>Median</b>	<b>11:04:00.00</b>	<b>07:01:00.00</b>
<b>Creating a sales proposal</b>		
<b>Time to turn on system (lower is better)</b>		
Run 1	00:06.50	00:11.10
Run 2	00:06.20	00:11.20
Run 3	00:06.50	00:11.30
<b>Median</b>	<b>00:06.50</b>	<b>00:11.20</b>
<b>Time to open new document in Google Docs (lower is better)</b>		
Run 1	00:03.50	00:08.20
Run 2	00:03.60	00:08.20
Run 3	00:03.70	00:08.00
<b>Median</b>	<b>00:03.60</b>	<b>00:08.20</b>
<b>Time to open PowerPoint presentation in Google Drive Viewer (lower is better)</b>		
Run 1	00:07.50	00:15.10
Run 2	00:07.80	00:15.10
Run 3	00:07.40	00:15.40
<b>Median</b>	<b>00:07.50</b>	<b>00:15.10</b>
<b>Time to start new Google Hangouts call with one other participant (lower is better)</b>		
Run 1	00:05.40	00:11.20
Run 2	00:04.90	00:11.00
Run 3	00:05.20	00:10.80
<b>Median</b>	<b>00:05.20</b>	<b>00:11.00</b>
<b>Time to share Google Docs document in Google Hangouts call (lower is better)</b>		
Run 1	00:08.40	00:17.60
Run 2	00:08.50	00:17.40
Run 3	00:08.20	00:17.30
<b>Median</b>	<b>00:08.40</b>	<b>00:17.40</b>
<b>Time to open existing document in Google Docs (lower is better)</b>		
Run 1	00:10.90	00:20.80
Run 2	00:10.50	00:21.10
Run 3	00:10.40	00:21.00
<b>Median</b>	<b>00:10.50</b>	<b>00:21.00</b>
<b>Time to convert Google Docs document to Word format (lower is better)</b>		
Run 1	00:02.10	00:04.10
Run 2	00:02.00	00:04.00
Run 3	00:02.20	00:03.80
<b>Median</b>	<b>00:02.10</b>	<b>00:04.00</b>

	Intel processor-powered Chromebook	ARM processor-based Chromebook
<b>Time to open Salesforce.com app opportunities dashboard (lower is better)</b>		
Run 1	00:07.70	00:16.70
Run 2	00:07.50	00:16.20
Run 3	00:07.20	00:16.70
<b>Median</b>	<b>00:07.50</b>	<b>00:16.70</b>
<b>Time to decrypt Excel spreadsheet (lower is better)</b>		
Run 1	00:05.80	00:10.90
Run 2	00:05.40	00:10.90
Run 2	00:05.40	00:10.60
<b>Median</b>	<b>00:05.40</b>	<b>00:10.90</b>
<b>Total time waiting</b>	<b>00:56.70</b>	<b>01:55.50</b>
<b>Managing a marketing plan</b>		
<b>Time to turn on system (lower is better)</b>		
Run 1	00:06.20	00:11.50
Run 2	00:06.50	00:11.50
Run 3	00:06.30	00:11.10
<b>Median</b>	<b>00:06.30</b>	<b>00:11.50</b>
<b>Time to open new presentation in PowerPoint Online (lower is better)</b>		
Run 1	00:03.30	00:07.00
Run 2	00:03.50	00:07.00
Run 3	00:03.40	00:06.70
<b>Median</b>	<b>00:03.40</b>	<b>00:07.00</b>
<b>Time to connect to Google Hangouts call with nine other participants (lower is better)</b>		
Run 1	00:06.70	00:17.60
Run 2	00:06.30	00:17.60
Run 3	00:06.50	00:17.40
<b>Median</b>	<b>00:06.50</b>	<b>00:17.60</b>
<b>Time to open MindMeister project plan mind map from Google Drive (lower is better)</b>		
Run 1	00:18.60	00:58.00
Run 2	00:18.40	00:58.70
Run 3	00:17.70	00:57.40
<b>Median</b>	<b>00:18.40</b>	<b>00:58.00</b>
<b>Time to open new document in Word Online (lower is better)</b>		
Run 1	00:04.20	00:08.20
Run 2	00:04.40	00:08.00
Run 3	00:04.50	00:08.00
<b>Median</b>	<b>00:04.40</b>	<b>00:08.00</b>
<b>Time to open project in Asana app (lower is better)</b>		
Run 1	00:06.80	00:13.30
Run 2	00:06.70	00:13.40
Run 3	00:06.60	00:12.90
<b>Median</b>	<b>00:06.70</b>	<b>00:13.30</b>
<b>Time to open existing presentation in PowerPoint Online (lower is better)</b>		
Run 1	00:06.20	00:12.80
Run 2	00:06.70	00:12.50
Run 3	00:06.10	00:13.00
<b>Median</b>	<b>00:06.20</b>	<b>00:12.80</b>

	Intel processor-powered Chromebook	ARM processor-based Chromebook
<b>Time to open Google Maps (lower is better)</b>		
Run 1	00:02.80	00:05.50
Run 2	00:02.50	00:05.40
Run 3	00:02.40	00:05.70
<b>Median</b>	<b>00:02.50</b>	<b>00:05.50</b>
<b>Time to enter Google Maps Street View (lower is better)</b>		
Run 1	00:01.80	00:03.20
Run 2	00:01.90	00:03.30
Run 3	00:01.70	00:03.30
<b>Median</b>	<b>00:01.80</b>	<b>00:03.30</b>
<b>Total time waiting</b>	<b>00:56.20</b>	<b>02:17.00</b>
<b>Delivering a fiscal report</b>		
<b>Time to turn on system (lower is better)</b>		
Run 1	00:06.30	00:11.40
Run 2	00:06.60	00:11.10
Run 3	00:06.50	00:11.30
<b>Median</b>	<b>00:06.50</b>	<b>00:11.30</b>
<b>Time to check for new messages in Outlook Web App (lower is better)</b>		
Run 1	00:04.80	00:11.80
Run 2	00:04.70	00:11.90
Run 3	00:04.70	00:11.50
<b>Median</b>	<b>00:04.70</b>	<b>00:11.80</b>
<b>Time to open existing document in Word Online (lower is better)</b>		
Run 1	00:11.00	00:17.00
Run 2	00:10.90	00:17.30
Run 3	00:11.20	00:17.10
<b>Median</b>	<b>00:11.00</b>	<b>00:17.10</b>
<b>Time to open existing spreadsheet in Excel Online (lower is better)</b>		
Run 1	00:07.10	00:14.20
Run 2	00:07.50	00:14.40
Run 3	00:07.60	00:14.50
<b>Median</b>	<b>00:07.50</b>	<b>00:14.40</b>
<b>Time to open existing spreadsheet in Google Sheets (lower is better)</b>		
Run 1	00:09.00	00:19.80
Run 2	00:08.80	00:20.40
Run 3	00:09.30	00:19.90
<b>Median</b>	<b>00:09.00</b>	<b>00:19.90</b>
<b>Time to connect to Google Hangouts call with one other participant (lower is better)</b>		
Run 1	00:06.10	00:15.10
Run 2	00:05.90	00:15.20
Run 3	00:05.70	00:15.50
<b>Median</b>	<b>00:05.90</b>	<b>00:15.20</b>
<b>Time to share Google Sheets spreadsheet in Google Hangouts call (lower is better)</b>		
Run 1	00:06.60	00:13.80
Run 2	00:06.80	00:14.00
Run 3	00:07.10	00:13.60
<b>Median</b>	<b>00:06.80</b>	<b>00:13.80</b>



	Intel processor-powered Chromebook	ARM processor-based Chromebook
<b>Time to view calendar in Outlook Web App (lower is better)</b>		
Run 1	00:07.80	00:17.00
Run 2	00:07.30	00:17.20
Run 3	00:07.40	00:16.70
<b>Median</b>	<b>00:07.40</b>	<b>00:17.00</b>
<b>Time to open Harvest timesheet (lower is better)</b>		
Run 1	00:03.70	00:07.00
Run 2	00:03.70	00:06.90
Run 3	00:03.90	00:06.80
<b>Median</b>	<b>00:03.70</b>	<b>00:06.90</b>
<b>Time to open Pandora (lower is better)</b>		
Run 1	00:03.80	00:06.40
Run 2	00:03.80	00:06.80
Run 3	00:04.20	00:06.20
<b>Median</b>	<b>00:03.80</b>	<b>00:06.40</b>
<b>Total time waiting</b>	<b>01:06.30</b>	<b>02:13.80</b>
<b>Planning a corporate event</b>		
<b>Time to turn on system (lower is better)</b>		
Run 1	00:06.70	00:10.90
Run 2	00:06.40	00:11.20
Run 3	00:06.40	00:11.40
<b>Median</b>	<b>00:06.40</b>	<b>00:11.20</b>
<b>Time to check HootSuite dashboard (lower is better)</b>		
Run 1	00:03.10	00:06.60
Run 2	00:03.30	00:06.40
Run 3	00:03.40	00:06.30
<b>Median</b>	<b>00:03.30</b>	<b>00:06.40</b>
<b>Time to open MindMeister brainstorming mind map from Google Drive (lower is better)</b>		
Run 1	00:11.90	00:22.90
Run 2	00:12.30	00:23.20
Run 3	00:12.20	00:23.40
<b>Median</b>	<b>00:12.20</b>	<b>00:23.20</b>
<b>Time to open new presentation in Google Slides (lower is better)</b>		
Run 1	00:05.50	00:11.40
Run 2	00:05.50	00:11.50
Run 3	00:05.60	00:11.60
<b>Median</b>	<b>00:05.50</b>	<b>00:11.50</b>
<b>Time to connect to Google Hangouts call with nine other participants (lower is better)</b>		
Run 1	00:06.70	00:17.80
Run 2	00:06.30	00:17.60
Run 3	00:06.60	00:17.40
<b>Median</b>	<b>00:06.60</b>	<b>00:17.60</b>
<b>Time to share Google Slides presentation in Google Hangouts call (lower is better)</b>		
Run 1	00:09.20	00:30.70
Run 2	00:09.50	00:30.20
Run 3	00:09.20	00:30.90
<b>Median</b>	<b>00:09.20</b>	<b>00:30.70</b>

	Intel processor-powered Chromebook	ARM processor-based Chromebook
<b>Time to open Google Keep (lower is better)</b>		
Run 1	00:01.10	00:02.80
Run 2	00:00.90	00:02.70
Run 3	00:00.90	00:02.60
<b>Median</b>	<b>00:00.90</b>	<b>00:02.70</b>
<b>Time to open existing presentation in Google Slides (lower is better)</b>		
Run 1	00:10.90	00:21.40
Run 2	00:10.90	00:21.50
Run 3	00:10.70	00:21.80
<b>Median</b>	<b>00:10.90</b>	<b>00:21.50</b>
<b>Time to open Windows-based application through Citrix virtual desktop (lower is better)</b>		
Run 1	00:09.60	00:11.50
Run 2	00:09.80	00:11.20
Run 3	00:10.20	00:11.80
<b>Median</b>	<b>00:09.80</b>	<b>00:11.50</b>
<b>Time to convert Google Slides presentation to PowerPoint format (lower is better)</b>		
Run 1	00:03.50	00:03.80
Run 2	00:03.20	00:04.20
Run 3	00:03.10	00:04.40
<b>Median</b>	<b>00:03.20</b>	<b>00:04.20</b>
<b>Total time waiting</b>	<b>01:08.00</b>	<b>02:20.50</b>

Figure 7: Detailed results.

## ABOUT PRINCIPLED TECHNOLOGIES



Principled Technologies, Inc.  
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