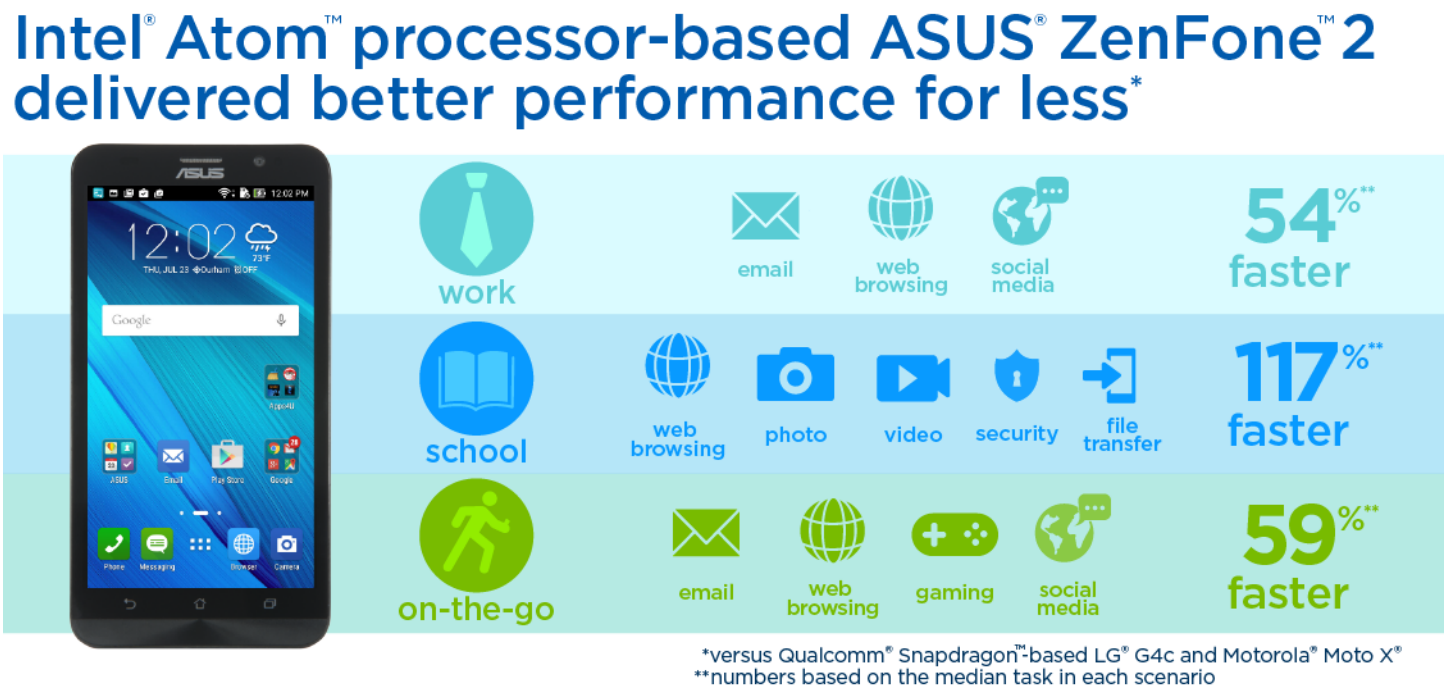
ANDROID PHONE COMPARISON: INTEL ATOM PROCESSOR-BASED ASUS ZENFONE 2 VS. QUALCOMM SNAPDRAGON PROCESSOR-BASED PHONES



Your phone is your constant companion. You may use it for social media, snapping photos, and playing games, for checking work email, or even for educational value if you're a student. Just like your computer, your phone has a processor, a brain that makes all this possible in the blink of an eye. The processor inside your phone can make or break your experience, because it dictates how fast you can perform these tasks.

The Intel Atom processor-based ASUS ZenFone 2 can improve your phone experience, no matter what you use it for. In hands-on tests at Principled Technologies, we found that the Intel Atom processor-based ASUS ZenFone 2 outperformed the Qualcomm Snapdragon-based LG G4c and Motorola Moto X (2nd gen, 2014), speeding up work-related tasks by a median improvement of up to 54 percent, making education tasks up to 117 percent faster, and improving the speed of daily tasks by up to 59 percent. The ASUS ZenFone 2 not only outperformed the other phones on our tasks, it also cost 22 percent less than the LG G4c and 17 percent less than the Motorola Moto X, which means you could get more bang for your buck.

When you're shopping for your new Android phone, look at the specs. As our tests showed, an ASUS ZenFone 2 with Intel Atom processor can have the power to provide a speedy experience on a wide range of tasks to ensure you'll love your phone.

JULY 2015 (Revised)
A PRINCIPLED TECHNOLOGIES REPORT
Commissioned by Intel Corp.

ANDROID PHONE SHOWDOWN

We put three phones to the test: the Intel Atom processor-based ASUS ZenFone 2 and two phones with Qualcomm Snapdragon processors, the LG G4c and Motorola Moto X. To find which performed the best, we loaded or performed tasks in a large number of apps related to work, school, and general use to see which completed tasks fastest. Continue reading to see how our results shaped up for three different scenarios. See Appendix A for phone details and Appendix B for detailed steps on how we tested each app. Appendix C shows how we calculated our winning percentages, which reflect the different rate of speed for the phones.

Which is the best choice for work?

Felicia has a demanding job running a non-profit. She needs to be available to answer questions at a moment's notice so her organization's clients aren't left out in the cold—literally. Felicia needs a phone that can retrieve her emails quickly and lets her browse the Web to help her come up with solutions in no time, so her group can better serve the public. Which Android phone can do the job?

We found that using the Intel Atom processor-based ASUS ZenFone 2, Felicia would be able to:

- check her email using Inbox by Gmail up to 54 percent faster than on the LG G4c
- get answers browsing the web up to 59 percent faster than on the LG G4c using Dolphin browser for Android
- post to her organization's Facebook page up to 25 percent faster than on the Motorola Moto X

Figure 1 shows how much the ASUS ZenFone 2 sped up tasks compared to the two competitor phones.

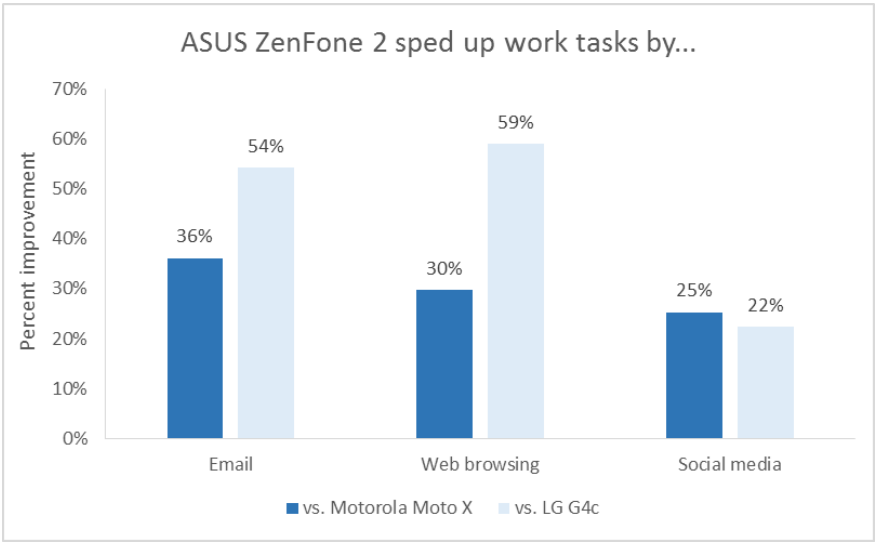


Figure 1: Felicia would be able to get her work tasks done more quickly with the Intel Atom processor-based ASUS ZenFone 2.

The speedier performance of the ASUS ZenFone 2 could help Felicia be more productive at work, which means she can make a little quicker progress in her quest to help her community.

Which is the best choice for school?

Ty has had a big year. He's in the eighth grade now, which comes with a lot more responsibility. His parents said they'd get him a phone, and now it's time to pick. Ty cares about keeping in touch with friends and playing games, but his dad wants to make sure he can use it for school as well. Ty's first assignment requires him to research local history on the Web for a brief paper and take pictures and capture video of his favorite local historical spots to share with the class. Which Android phone passes the test?

We found that using the Intel Atom processor-based ASUS ZenFone 2, Ty could:

- browse the web for his assignment up to 59 percent faster than on the LG G4c
- create a time-lapse video using Lapse It up to 87 percent faster than on the LG G4c
- use PicsArt Studio to edit photos for his report up to 117 percent faster than on the LG G4c
- scan for viruses before sharing media up to 1,535 percent faster than on the Motorola Moto X (put differently, the other phones took up to 15.5 times longer to do the scan)
- download a classmate's file up to 363 percent faster than on the LG G4c using WiFi File Transfer Pro

Figure 2 shows how much the ASUS ZenFone 2 sped up tasks compared to the two competitor phones.

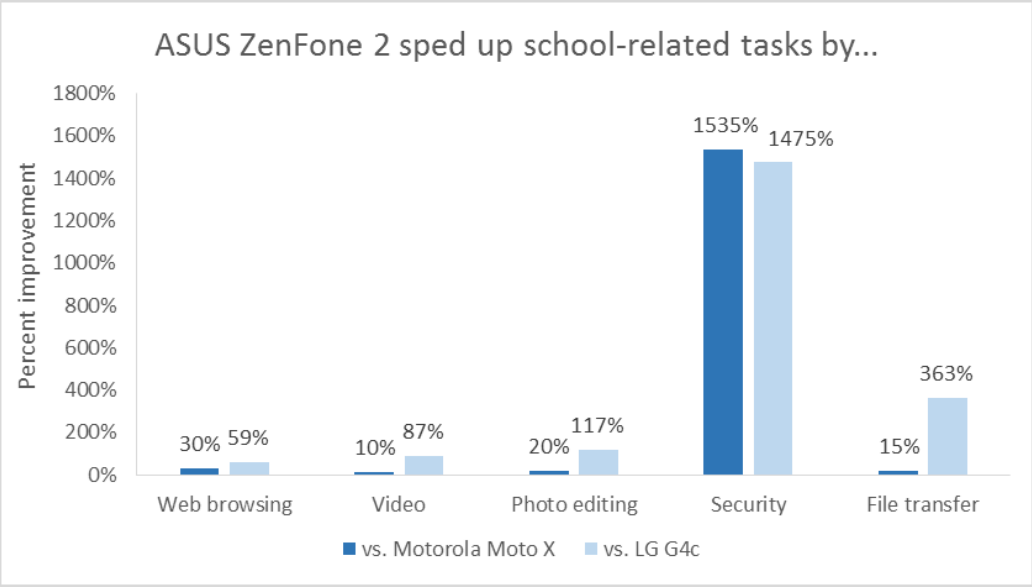


Figure 2: Ty would be able to complete his school assignment more quickly with the Intel Atom processor-based ASUS ZenFone 2.

The speedier performance of the ASUS ZenFone 2 could help keep Ty engaged with his assignment and make it an overall better experience, ultimately helping him learn more.

Which is the best choice for on-the-go?

Amelia's life is busy. As a college student, she has many social obligations, interns at a magazine, and still has to complete coursework for her journalism degree. She needs a phone that can help her keep up with everything: her friends' events on Facebook, the latest games, requests from her boss at the magazine, and on-the-go research as she fleshes out ideas for her journalism papers. Which Android phone can help her do it all?

We found that the Intel Atom processor-based ASUS ZenFone 2 would let Amelia:

- check her messages on Facebook Messenger up to 59 percent faster than on the LG G4c
- load her favorite game up to 91 percent faster than on the LG G4c
- access an email from her boss up to 54 percent faster than on the LG G4c
- do web research up to 59 percent faster than on the LG G4c with the Dolphin Browser for Android

Figure 3 shows how much the ASUS ZenFone 2 sped up tasks compared to the two competitor phones.

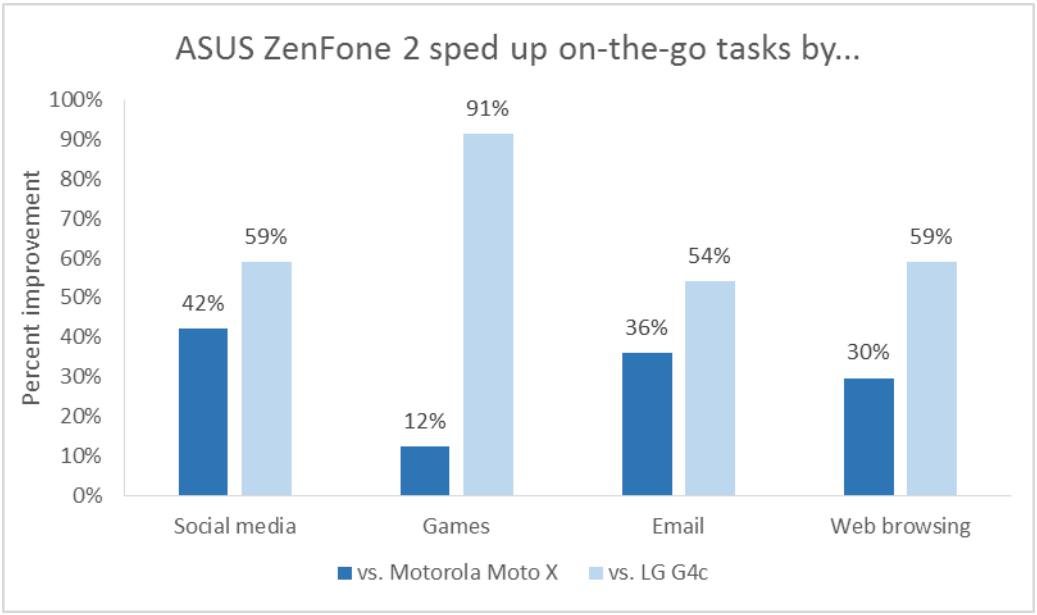


Figure 3: Amelia would be able to complete her day-to-day tasks more quickly with the Intel Atom processor-based ASUS ZenFone 2.

The speedier performance of the ASUS ZenFone 2 could help Amelia stay in touch, stay entertained, and answer work and school questions more quickly, which means she can get it all done with less frustration.

DETAILED RESULTS

We found that the Intel Atom processor empowered the ASUS ZenFone 2 to work faster than the Qualcomm Snapdragon-based LG G4c and Motorola Moto X in a number of different areas, including email, Web browsing, photo, video, gaming, and social media. In addition to the apps we cite in our use cases above, we tested other popular apps in each category.

Figure 4 shows how the phones fared on photo/video apps we tested.

Photo/video apps					
App name	**ASUS ZenFone 2 (Intel Atom processor)**	**Motorola Moto X (Qualcomm Snapdragon processor)**	**LG G4c (Qualcomm Snapdragon processor)**	**% win vs. Moto X**	**% win vs. G4c**
Flipagram	2.71	3.97	4.00	47%	48%
Lapse It Time Lapse Camera	2.81	3.08	5.25	10%	87%
Photo Grid - Collage Maker	2.77	3.53	3.21	27%	16%
PicsArt Photo Studio	2.56	3.06	5.55	20%	117%
Voice changer with effects	1.22	1.31	1.37	7%	12%
Average				**22%**	**56%**

Figure 4: The times (in seconds) it took to launch or complete tasks on the listed photo/video apps.

Figure 5 shows how the phones compared on social media apps.

Social media apps					
App name	**ASUS ZenFone 2 (Intel Atom processor)**	**Motorola Moto X (Qualcomm Snapdragon processor)**	**LG G4c (Qualcomm Snapdragon processor)**	**% win vs. Moto X**	**% win vs. G4c**
Facebook	3.72	4.66	4.55	25%	22%
Instagram	1.03	1.25	1.13	21%	10%
Messenger	1.61	2.29	2.56	42%	59%
Pinterest	1.97	2.36	2.56	20%	30%
WhatsApp Messenger	1.50	1.69	2.03	12%	35%
Average				**24%**	**31%**

Figure 5: The times (in seconds) it took to launch or complete tasks on the listed social media apps.

Figure 6 shows how the phones compared on email apps.

Email apps					
App name	ASUS ZenFone 2 (Intel Atom processor)	Motorola Moto X (Qualcomm Snapdragon processor)	LG G4c (Qualcomm Snapdragon processor)	% win vs. Moto X	% win vs. G4c
Gmail	1.19	1.41	1.46	19%	23%
Inbox by Gmail	1.44	1.96	2.22	36%	54%
Microsoft Outlook	2.03	2.60	2.81	28%	38%
Yahoo Mail - Free Email App	2.69	3.63	3.69	35%	37%
Average				**29%**	**38%**

Figure 6: The times (in seconds) it took to launch or complete tasks on the listed email apps.

Figure 7 shows how the phones compared on different Web browsers.

Web browser apps					
App name	ASUS ZenFone 2 (Intel Atom processor)	Motorola Moto X (Qualcomm Snapdragon processor)	LG G4c (Qualcomm Snapdragon processor)	% win vs. Moto X	% win vs. G4c
Baidu Browser (Fast & Secure)	2.41	3.06	3.75	27.0%	55.6%
Chrome Browser - Google	2.50	2.67	2.63	6.8%	5.2%
Dolphin Browser for Android	2.29	2.97	3.64	29.7%	59.0%
Firefox Browser for Android	1.68	2.13	2.00	26.8%	19.0%
UC Browser for Android	0.93	1.02	1.03	9.7%	10.8%
Average				**20.0**	**29.9%**

Figure 7: The times (in seconds) it took to launch or complete tasks on the listed Web browser apps.

Figure 8 shows how the phones compared on gaming apps.

Gaming apps					
App name	ASUS ZenFone 2 (Intel Atom processor)	Motorola Moto X (Qualcomm Snapdragon processor)	LG G4c (Qualcomm Snapdragon processor)	% win vs. Moto X	% win vs. G4c
Angry Birds	0.62	0.69	0.81	11%	31%
Crazy Kitchen	2.50	2.69	3.91	8%	56%
Cut the Rope 2	2.34	2.58	3.06	10%	31%
Frozen Free Fall	3.13	3.38	4.97	8%	59%
Hungry Shark Evolution	6.78	7.62	12.97	12%	91%
Average				**10%**	**54%**

Figure 8: The times (in seconds) it took to launch or complete tasks on the listed gaming apps.

Figure 9 shows how the phones compared on security scans and file transferring.

Security scan/ file transfer					
App name	ASUS ZenFone 2 (Intel Atom processor)	Motorola Moto X (Qualcomm Snapdragon processor)	LG G4c (Qualcomm Snapdragon processor)	% win vs. Moto X	% win vs. G4c
Anti-virus Dr.Web v.9 Light - Quick Scan - Normalized	0.20	3.27	3.15	1,535%	1,475%
WiFi File Transfer Pro	8.69	10.03	40.19	15%	363%

Figure 9: The times (in seconds) it took to complete a virus scan for 1GB of data or to upload a 121.9MB test file.

Figure 10 compares the prices of the phones. As of August 7, 2015, the ASUS ZenFone 2 was available from amazon.com at a cost 22 percent less than the LG G4c and 17 percent less than the Motorola Moto X.

Cost					
App name	ASUS ZenFone 2 (Intel Atom processor)	Motorola Moto X (Qualcomm Snapdragon processor)	LG G4c (Qualcomm Snapdragon processor)	% win vs. Moto X	% win vs. G4c
Cost	$299.00[1]	$359.99[2]	$383.22[3]	17%	22%

Figure 10: The cost of the three phones (unlocked) from amazon.com as of 08/07/15. Prices do not include tax or shipping.

CONCLUSION

In our tests, when it came to loading apps or completing routine tasks in email, Web browsing, photo and video, gaming, and social media, the Intel Atom processor-based ASUS ZenFone 2 performed faster than the Qualcomm Snapdragon-based LG G4c and Motorola Moto X.

Felicia would be able to get to her emails up to 54 percent faster[4] so she could help her clients sooner. Ty could get his video going for his school project up to 87 percent faster.[5] And Amelia could access her social media conversations up to 59 percent faster.[6]

When you choose your Android phone companion, make sure it has a powerful processor that can help you load your apps and complete tasks quickly: your day-to-day experience at work, home, or on-the-go depends on it.

[1] http://www.amazon.com/ASUS-ZenFone-Cellphone-Black-Unlocked/dp/B00VWKKEYO/ref=sr_1_2?s=wireless&ie=UTF8&qid=1438975384&sr=1-2&keywords=asus+zenfone+2

[2] http://www.amazon.com/Motorola-Moto-16GB-XT1092-2014/dp/B00N4NQ8TC

[3] http://www.amazon.com/LG-H525N-CERAMIC-FACTORY-UNLOCKED/dp/B00YHJ9DU8/ref=sr_1_2?ie=UTF8&qid=1438896875&sr=8-2&keywords=LG+G4c

[4] Compared to the LG G4c.

[5] Compared to the LG G4c.

[6] Compared to the LG G4c.

APPENDIX A – SYSTEM CONFIGURATION INFORMATION

Figure 11 provides detailed configuration information for the phones we used in our tests.

System	ASUS ZenFone 2 (ZE551ML)	LG G4c (H525N)	Motorola Moto X (XT1092) (Second generation, 2014)
Processor	Intel Atom Z3580	Qualcomm Snapdragon 410 (MSM8916)	Qualcomm Snapdragon 801 (MSM8974)
Processor (GHz)	2.3	1.2	2.5
Processor cores	4	4	4
Memory (GB)	4	1	2
Storage (GB)	64	8	16
Battery capacity (mAh)	3,000	2,540	2,300
Display	5.5" (1920 × 1080)	5" (720 × 1280)	5.2" (1080 × 1920)
Wireless	802.11 a/b/g/n/ac	802.11 a/b/g/n	802.11 a/b/g/n/ac
Bluetooth®	4.0	4.1	4.0
System weight (lbs.)	0.38	0.30	0.32
Front camera (MP)	5	5	2
Rear camera (MP)	13	8	13
OS	Android 5.0	Android 5.0.2	Android 5.1
Price[7]	$299.00	$383.22	$359.99

Figure 11: Configuration information for the phones we tested.

[7] Unlocked phone prices from Amazon.com (US) as of 08/07/2015. Prices do not include tax or shipping.

APPENDIX B – HOW WE TESTED

Note: In between each run, clear the app cache, close the app being tested, and ensure no apps are running in the background.

1. Navigate to the Android Settings app.
2. Select Apps.
3. Select the app currently under testing.
4. Select CLEAR CACHE.
5. Close the settings app and proceed with timing.

Flipagram

1. Launch the app.
2. Select the '+' in the bottom right.
3. Select 8 test photos.
4. Select Next.
5. Start the timer, and select Next.
6. Stop the timer when the loading bar disappears.

Lapse It Time Lapse Camera

1. Launch the app.
2. Select New Capture.
3. Select Capture.
4. Stop the capture when 15 frames have been collected.
5. Select Render.
6. Start the timer, and select Create Video.
7. Stop the timer when the loading bar completes.

Photo Grid – Collage Maker

1. Open the App.
2. Select Grid.
3. Select 10 photos. Ensure the photos are shot with the device's camera and are all of the same objects.
4. Start the timer, and select Next.
5. Stop the timer when the collage appears and the loading animation stops.

PicsArt Photo Studio

1. Open the app.
2. Select Edit.
3. Select Gallery.
4. Select the test photo, and start the timer.
5. Stop the timer when the image is loaded for editing.

Voice Changer With Effects

1. Launch the app, and start the timer.
2. Stop the timer when the effects menu loads.

Facebook

Note: Ensure Facebook app has been set up completely – including logging into an account for the first time.

1. Simultaneously start the timer and tap the app icon.

2. Stop the timer when the spinning loading indicator on the news feed disappears.

Instagram

Note: Ensure app has been set up completely. Use the same account on all devices.

1. Launch the App.
2. Simultaneously start the timer and tap the camera button.
3. Stop the timer.

Messenger

Note: Ensure app has been set up completely. Use the same account on all devices.

1. Start the timer, and tap the app icon.
2. Stop the timer when the list of contacts appears.

Pinterest

Note: Ensure app has been set up completely. Use the same account on all devices.

1. Start the timer, and tap the app icon.
2. Stop the timer when the feed finishes loading and all images appear.

WhatsApp

Note: Ensure app has been set up completely. Use the same account on all devices.

1. Start the timer, and tap the app icon.
2. Stop the timer when the list of messages appears.

Gmail

Note: Ensure app has been set up completely. Use the same account on all devices.

1. Launch the app.
2. Start the timer and tap the compose message in the lower right.
3. Stop the timer when the new message window appears and the keyboard finishes sliding in.

Inbox for Gmail

Note: Ensure app has been set up completely. Use the same account on all devices.

1. Start the timer, and tap the app icon.
2. Stop the timer when the email list fully loads.

Yahoo Mail

Note: Ensure app has been set up completely. Use the same account on all devices.

1. Start the timer, and tap the app icon.
2. Stop the timer when the login screen appears fully and all buttons are shown.

Baidu Browser

Note: Ensure app has been set up completely. Clear the web cache in the app's settings between runs.

1. Launch the app.
2. Enter www.wikipedia.org into the URL bar.
3. Start the timer, and select Go.
4. Stop the timer when all web content finishes loading.

Chrome Browser

Note: Ensure app has been set up completely. Clear the web cache in the app's settings between runs.

1. Launch the app.
2. Enter www.amazon.com into the URL bar.
3. Start the timer, and select Go.
4. Stop the timer when all web content finishes loading.

Dolphin Browser

Note: Ensure app has been set up completely. Clear the web cache in the app's settings between runs.

1. Launch the app.
2. Enter www.youtube.com into the URL bar.
3. Start the timer, and select Go.
4. Stop the timer when all web content finishes loading.

Firefox Browser

Note: Ensure app has been set up completely. Clear the web cache in the app's settings between runs.

1. Start the timer, and tap the app icon.
2. Stop the timer when the favorites screen fully loads.

UC Browser

Note: Ensure app has been set up completely. Clear the web cache in the app's settings between runs.

1. Start the timer, and tap the app icon.
2. Stop the timer when the app fully loads.

Gaming apps

Angry Birds

1. Open the app.
2. Select the Play button.
3. Select 'Poached Eggs'
4. Select 1, and start the timer. When the level loads, stop the timer.

Crazy Kitchen

1. Open the app.
2. Select a level – we chose Level 2.
3. Select the play icon, and start the timer.
4. Stop the timer when the level is fully loaded.

Cut the Rope 2

1. Open the app.
2. Press the Play icon.
3. Tap a level.
4. Select the play icon, and start the timer.
5. Stop the timer when the level finishes loading.

Frozen Free Fall

1. Open the app.
2. Select Play.
3. Select a level. We chose level 2.
4. Start the timer, and select Play.
5. Stop the timer when the loading screen disappears.

Hungry Shark Evolution

1. Open the app.
2. Select Play, and start the timer.
3. Stop the timer when the shark hits the water.

Security scans and file transferring apps

Anti-virus Dr. Web Light

1. Open the app.

2. Tap Scanning.
3. Tap Quick Scan.
4. Record the number of seconds the app provides for the time it took to perform the quick scan.

Wifi File Transfer Pro

1. Open the app.
2. Select Start.
3. On a separate computer, navigate to the IP address shown.
4. Select Upload files.
5. Select a test file. We used a 121.9MB File.
6. Select Start Upload and start the timer.
7. Stop the timer when the upload completes.

APPENDIX C – RATE CALCULATIONS

The formula that we used to calculate the rate faster that the Intel Atom processor-based ASUS ZenFone 2 was is as follows:

$$\%\ Intel\ faster = \frac{Rate\ of\ Intel}{Rate\ of\ Compeition} - 1$$

For example, A takes 50 sec to complete a task and B takes 25 sec to complete a task, calculate % of B faster than A.

$$\%\ B\ faster\ than\ A = \frac{Rate\ of\ B}{Rate\ of\ A} = \frac{\frac{1\ task}{25\ seconds}}{\frac{1\ task}{50\ seconds}} = \frac{50}{25} = 2 - 1 = 100\%\ faster$$

ABOUT PRINCIPLED TECHNOLOGIES

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

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.

When the assessment is complete, we know how to present the results to a broad range of target audiences. We provide our clients with the materials they need, from market-focused data to use in their own collateral to custom sales aids, such as test reports, performance assessments, and white papers. Every document reflects the results of our trusted independent analysis.

We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to help our clients assess how it will fare against its competition, its performance, its market readiness, and its quality and reliability.

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.