



AppCensus

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1,000 Mobile Apps in Australia: Appendix D: Other Apps

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D Other Apps

In this section, we present our analysis across all 797 apps in the Other category. Given the size of the category, we present the analysis further broken down by the categories associated with each in the Google Play Store. Based on these, we identified the 10 most popular categories in Table 47. These 10 most popular categories represent 79.2% of the 797 apps labeled Other. Additionally, Figure 33 depicts a summary view of the approximate locations of the companies' Internet servers—as determined by geolP lookups—to which these apps were observed transmitting information during the testing period.

Google Play Store Category	# of Apps	(% of Apps)
Games (Section D.1)	163	(20.5%)
Tools (Section D.2)	96	(12.0%)
Communication (Section D.3)	75	(9.4%)
News & Magazines (Section D.4)	66	(8.3%)
Productivity (Section D.5)	56	(7.0%)
Social (Section D.6)	41	(5.1%)
Personalization (Section D.7)	41	(5.1%)
Finance (Section D.8)	34	(4.3%)
Entertainment (Section D.9)	31	(3.9%)
Music & Audio (Section D.10)	28	(3.5%)

Table 47: Top 10 Google Play Store categories for the apps in the Other category.

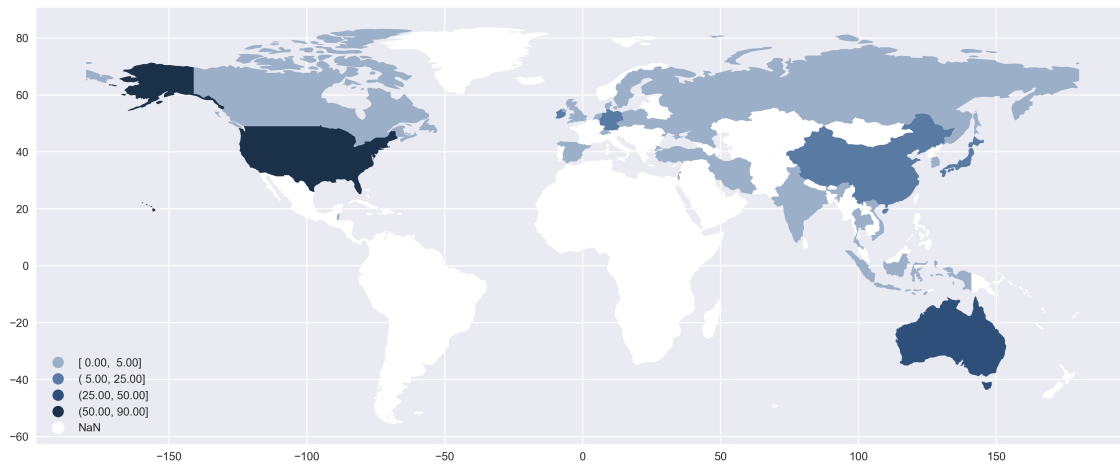


Figure 33: Percentage of Other apps transmitting to different countries during testing.

D.1 Games Apps

D.1.1 Data Types Transmitted

Apps in the Games category were observed transmitting the data types listed in Table 48 during the testing period.¹⁰⁵

Data Type	# of Apps	(% of Apps)
AAID	143	(87.7%)
Android ID	108	(66.3%)
BT Name	35	(21.5%)
WiFi MAC	5	(3.1%)
BT SSID	4	(2.5%)
BT BSSID	3	(1.8%)
GPS Location	2	(1.2%)
Coarse Location	2	(1.2%)
GSF ID	1	(0.6%)
Name	1	(0.6%)
Email	1	(0.6%)

Table 48: Data types transmitted by apps in the Games category during the testing period.

¹⁰⁵For an explanation of these data types, see Section 3.

D.1.1.1 Most Common Hostnames Contacted

Table 49 depicts the top 10 hostnames observed being contacted by Games apps during the testing period, whereas Table 50 depicts the top 10 parent companies corresponding to these hostnames. This data reflects Internet servers that were *contacted* by apps, but does not necessarily mean that they received sensitive user information—we specifically discuss that subset of recipients in Section D.1.1.2.¹⁰⁶ The discrepancy between the two sections is due to the fact that some app transmissions may simply not contain sensitive user information or that its transmission was obfuscated using a method that we did not immediately recognize.

Hostname	Parent Company	# of Apps	(% of Apps)
graph.facebook.com	Facebook	130	(79.8%)
settings.crashlytics.com	Google	74	(45.4%)
googleads.g.doubleclick.net	Google	72	(44.2%)
www.facebook.com	Facebook	66	(40.5%)
rt.applovin.com	AppLovin	53	(32.5%)
d.applovin.com	AppLovin	53	(32.5%)
publisher-config.unityads.unity3d.com	Unity Technologies	52	(31.9%)
config.unityads.unity3d.com	Unity Technologies	52	(31.9%)
webview.unityads.unity3d.com	Unity Technologies	52	(31.9%)
auction.unityads.unity3d.com	Unity Technologies	51	(31.3%)

Table 49: The top 10 most common hostnames contacted by Games apps during testing.

Company	# of Apps	(% of Apps)
Facebook	133	(81.6%)
Google	109	(66.9%)
Unity Technologies	75	(46.0%)
AppLovin	53	(32.5%)
AppsFlyer	51	(31.3%)
Adjust	48	(29.4%)
Oracle	44	(27.0%)
Liftoff	36	(22.1%)
Twitter	33	(20.2%)
Ironsource	30	(18.4%)

Table 50: The top 10 most common companies contacted by Games apps during testing.

¹⁰⁶We define “user information” in Section 3.

D.1.1.2 Most Common Data Recipients

Table 51 depicts the top 10 data recipients among the Games apps during the testing period. Table 52 lists additional information about the most common data recipients, such as the approximate locations of their servers, IP addresses contacted during testing, and the types of sensitive user information that we observed them receive during the testing period.

Hostname	Parent Company	# of Apps	(% of Apps)
graph.facebook.com	Facebook	115	(70.6%)
publisher-config.unityads.unity3d.com	Unity Technologies	52	(31.9%)
www.facebook.com	Facebook	51	(31.3%)
auction.unityads.unity3d.com	Unity Technologies	50	(30.7%)
app.adjust.com	Adjust	44	(27.0%)
cdp.cloud.unity3d.com	Unity Technologies	42	(25.8%)
config.uca.cloud.unity3d.com	Unity Technologies	41	(25.2%)
t.appsflyer.com	AppsFlyer	33	(20.2%)
outcome-ssp.supersonicads.com	Ironsource	30	(18.4%)
init.supersonicads.com	Ironsource	30	(18.4%)

Table 51: The top 10 most common data recipients from Games apps during testing.

Table 52: The 10 most common recipient hostnames of user information from Games apps during the testing period, along with their IP addresses, company information, and the data types that were observed being transmitted.

Parent Company	Country	IPs	Received Data
graph.facebook.com			
Facebook	United States	157.240.8.18 (US)	Android ID AAID
publisher-config.unityads.unity3d.com			
Unity Technologies	United States	35.244.185.185 (US)	AAID
www.facebook.com			
Facebook	United States	157.240.8.35 (US)	AAID
auction.unityads.unity3d.com			
Unity Technologies	United States	34.67.211.26 (US) 104.198.47.225 (US) 35.193.166.123 (US) 34.70.192.248 (US) 146.148.56.16 (US) 35.226.19.215 (US) 34.69.72.203 (US) 35.223.148.251 (US) 146.148.93.11 (US) 35.202.128.162 (US) 35.192.26.53 (US) 34.71.67.107 (US) 104.154.237.78 (US) 35.192.64.203 (US) 34.67.147.66 (US) 35.192.119.84 (US) 35.232.148.149 (US) 104.154.189.223 (US) 104.198.52.73 (US) 35.192.82.31 (US) 34.69.248.143 (US) 35.224.36.221 (US) 35.222.83.253 (US) 35.225.23.195 (US) 35.239.54.240 (US) 34.66.96.2 (US) 35.224.35.221 (US) 35.225.10.4 (US) 35.202.183.22 (US) 35.222.218.50 (US) 35.192.32.172 (US) 104.154.232.41 (US) 34.69.25.57 (US)	AAID

(Table Continues)

Table 52 (Continued)

Parent Company	Country	IPs	Received Data
app.adjust.com			
Adjust	United States	185.151.204.11 (DE) 185.151.204.8 (DE) 185.151.204.12 (DE) 185.151.204.15 (DE) 185.151.204.13 (DE) 185.151.204.7 (DE) 185.151.204.9 (DE) 185.151.204.14 (DE) 185.151.204.6 (DE) 185.151.204.10 (DE)	Android ID Aaid
cdp.cloud.unity3d.com			
Unity Technologies	United States	35.241.52.229	BT Name Android ID Aaid
config.uca.cloud.unity3d.com			
Unity Technologies	United States	35.241.26.53 (US)	Android ID
t.appsflyer.com			
(Table Continues)			

Table 52 (Continued)

Parent Company	Country	IPs	Received Data
AppsFlyer	United States	54.76.225.200 (IE)	Android ID AAID
		52.31.58.230 (IE)	
		52.17.162.114 (IE)	
		52.30.132.239 (IE)	
		18.200.153.9 (IE)	
		52.210.38.150 (IE)	
		34.250.174.133 (IE)	
		52.18.129.177 (IE)	
		52.209.80.246 (IE)	
		99.81.64.84 (IE)	
		34.248.134.84 (IE)	
		54.154.31.194 (IE)	
		34.248.218.13 (IE)	
		52.17.153.26 (IE)	
		52.211.184.217 (IE)	
		52.213.232.35 (IE)	
		52.209.251.85 (IE)	
		54.76.242.61 (IE)	
		34.248.172.20 (IE)	
		54.154.23.54 (IE)	
		54.154.50.165 (IE)	
108.128.35.102 (IE)			
34.247.131.228 (IE)			
63.32.242.5 (IE)			
3.248.114.5 (IE)			
52.48.254.152 (IE)			
34.251.155.19 (IE)			
18.200.64.92 (IE)			
52.211.152.255 (IE)			
34.252.247.192 (IE)			
52.49.77.123 (IE)			
34.249.125.164 (IE)			
outcome-ssp.supersonicads.com			
Ironsource	Israel	13.226.254.69 (US)	Android ID AAID
		13.226.254.51 (US)	
		99.84.224.81 (US)	
		13.226.214.50 (US)	
		13.226.254.121 (US)	
		13.226.214.4 (US)	
		13.226.198.120 (US)	
		99.84.224.113 (US)	
		99.84.224.95 (US)	
		13.226.198.36 (US)	
		13.226.214.63 (US)	
99.84.224.43 (US)			
13.226.198.93 (US)			
init.supersonicads.com			
(Table Continues)			

Table 52 (Continued)

Parent Company	Country	IPs	Received Data
Ironsource	Israel	52.21.145.59 (US)	Android ID AAID
		13.226.85.17 (US)	
		13.226.85.97 (US)	
		13.226.111.111 (US)	
		13.224.175.87 (US)	
		54.208.180.232 (US)	
		52.87.1.66 (US)	
		52.87.15.12 (US)	
		99.86.212.109 (US)	
		13.226.85.114 (US)	
		13.226.111.9 (US)	
		13.226.111.108 (US)	
		54.208.186.145 (US)	
		13.32.73.15 (US)	
		99.86.212.74 (US)	
		99.86.212.41 (US)	
		13.35.149.125 (US)	
13.35.149.120 (US)			
13.226.85.62 (US)			
13.224.175.6 (US)			

D.1.1.3 Apps Ranked by Number of Recipients

Table 53 ranks the Games apps based on the number of recipients to which we detected each transmit sensitive user information during testing.

Table 53: Games apps ordered by the number of recipients (by unique hostnames and their parent companies) during the testing period.

App	Developer	Installs	Recipients	
			Hostnames	Companies
Paper.io 2 Package Name: io.voodoo.paper2 Version: 1.5.5 (155)	VOODOO	100,000,000	28	16
Happy Color™ –Color by Number Package Name: com.pixel.art.coloring.color.number Version: 2.8.3 (99)	X-Flow	50,000,000	21	14
Idle Miner Tycoon: Mine & Money Clicker Management Package Name: com.fluffyfairygames.idleminertycoon Version: 3.02.0 (43265)	Kolibri Games	50,000,000	25	14
Spider Solitaire Package Name: com.mobilityware.spider Version: 5.5.3.3493 (3493)	MobilityWare	10,000,000	24	14
FreeCell Solitaire Package Name: com.mobilityware.freecell Version: 5.3.3.3332 (3332)	MobilityWare	10,000,000	24	14
Solitaire Package Name: com.mobilityware.solitaire Version: 6.5.0.3492 (3492)	MobilityWare	100,000,000	22	13
Sniper 3D: Fun Free Online FPS Shooting Game Package Name: com.fungames.sniper3d Version: 3.12.1 (6927)	Fun Games For Free	100,000,000	18	13
Slot Machines –Slots of Immortality™ Free Pokies Package Name: com.bi.slots.immortality Version: 1.46.3 (3003)	Bad Ibis Games Ltd	100,000	21	13
Brain Test: Tricky Puzzles Package Name: com.unicostudio.brainatest Version: 2.653 (141)	Unico Studio	50,000,000	28	12
Lucky Time - Win Rewards Every Day Package Name: com.luckyapp.winner Version: 3.1.54 (54)	Lucky Lucky Team	10,000,000	23	12
Fishdom Package Name: com.playrix.fishdomdd.gplay Version: 4.82.0 (928048200)	Playrix	100,000,000	17	11

(Table Continues)

Table 53 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Pixel Art: Color by Number Package Name: com.europosit.pixelcoloring Version: 4.9 (1110049019)	Easybrain	50,000,000	20	11
theScore: Live Sports Scores, News, Stats & Videos Package Name: com.fivemobile.thescore Version: 20.8.0 (20080)	theScore, Inc.	10,000,000	12	11
Word Stacks Package Name: com.peoplefun.wordstacks Version: 1.5.1 (440)	PeopleFun	10,000,000	20	11
Onefootball - Soccer Scores Package Name: de.motain.liga Version: 12.9.1.8034 (1012099034)	Onefootball GmbH	10,000,000	15	10
BlockuDoku - Block Puzzle Game Package Name: com.easybrain.block.puzzle.games Version: 1.3.0 (13009)	Easybrain	10,000,000	16	10
Words With Friends –Word Puzzle Package Name: com.zynga.wwf2.free Version: 14.521 (14521)	Zynga	10,000,000	15	10
Tycoon Casino™: Free Vegas Jackpot Slots Package Name: com.tw.tycoon.casino Version: 1.5.2 (152)	Triwin Games	5,000,000	12	10
Make it perfect Package Name: com.game.perfection Version: 1.0.17 (24)	VOODOO	1,000,000	17	10
Cash Storm Casino - Online Vegas Slots Games Package Name: com.cashstorm.slots Version: 1.2.5 (125)	TRIWIN	1,000,000	13	10
Solitaire Package Name: com.tripledot.solitaire Version: 2.5.0 (236)	Tripledote Studios Limited	1,000,000	17	10
Lucky Time - Win Your Lucky Day & Real Money Package Name: playgame.realmoney.free.scratchers.win.luckytime Version: 1.3.46 (103046)	Luckytime App Team	500,000	19	10
Jelly Drops - Free Puzzle Games Package Name: com.cookapps.playgrounds.ff.jellypopmania Version: 4.0.4 (200092)	CookApps	100,000	22	10
Paint By Number - Free Coloring Book & Puzzle Game Package Name: paint.by.number.pixel.art.coloring.drawing.puzzle Version: 2.18.3 (1259)	Better Life - Color and Draw	50,000,000	14	9
Nonogram.com - Picture cross puzzle game Package Name: com.easybrain.nonogram	Easybrain	10,000,000	15	9

(Table Continues)

Table 53 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Version: 2.1.0 (21012) Jigsaw Puzzles - Puzzle Game Package Name: com.easybrain.jigsaw.puzzles Version: 1.5.0 (15005)	Easybrain	10,000,000	16	9
Double Win Casino Slots - Free Vegas Casino Games Package Name: com.huge.slots.casino.vegas.android.avidly Version: 1.46 (146)	Free Royal Slot Casino	1,000,000	14	9
Gold Fortune Casino™ - Free Vegas Slots Package Name: triwin.casino.slots.fortune.gold Version: 5.3.0.151 (151)	TRIWIN	1,000,000	12	9
Word Expert Package Name: com.pisanu.scrabbleexpert.free Version: 4.3 (82)	Pisanu Chaloeprattanaorn	100,000	13	9
Johnny Trigger Package Name: com.time.trigger Version: 1.8.6 (29)	SayGames	50,000,000	19	8
Words With Friends 2 -Free Word Games & Puzzles Package Name: com.zynga.words3 Version: 14.521 (14521)	Zynga	10,000,000	11	8
Wordscapes Package Name: com.peoplefun.wordcross Version: 1.7.0 (1128)	PeopleFun	10,000,000	18	8
Archer0 Package Name: com.habby.archero Version: 1.4.7 (429)	Habby	10,000,000	15	8
My Talking Tom 2 Package Name: com.outfit7.mytalkingtom2 Version: 2.0.1.962 (360)	Outfit7 Limited	100,000,000	12	7
Tiles Hop: EDM Rush! Package Name: com.amanotes.beathopper Version: 3.1.9 (500148)	AMANOTES	100,000,000	23	7
Magic Tiles 3 Package Name: com.youmusic.magictiles Version: 7.063.006 (2006311912)	AMANOTES	100,000,000	21	7
Sudoku.com - Free Sudoku Puzzles Package Name: com.easybrain.sudoku.android Version: 2.7.0 (27001)	Easybrain	10,000,000	10	7
Covet Fashion - Dress Up Game Package Name: com.crowdstar.covetfashion Version: 20.04.202 (2020050602)	Crowdstar Inc	10,000,000	13	7
Sharpen Blade	ZPLAY Games (Table Continues)	10,000,000	11	7

Table 53 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Package Name: com.zplay.blade Version: 1.21.0 (18)				
ESPN Fantasy Sports Package Name: com.espn.fantasy.lm.football Version: 7.2.0 (565)	ESPN Inc	5,000,000	11	7
Idle Army Base Package Name: com.neonplay.casualidlearmybase Version: 1.10.2 (271)	Neon Play	5,000,000	21	7
Happy Wheels Package Name: com.fancyforce.happywheels Version: 1.0.6 (23)	James Bonacci	5,000,000	18	7
TOP SEED Tennis: Sports Management Simulation Game Package Name: com.gaminho.topseedtennis Version: 2.42.7 (2042007000)	Gaminho	1,000,000	13	7
Voetbalzone Package Name: com.nakko.android.voetbalzone Version: 3.0.2 (3024)	Voetbalzone B.V.	100,000	8	7
Cricbuzz - Live Cricket Scores & News Package Name: com.cricbuzz.android Version: 4.6.005 (1521046005)	Cricbuzz.com	100,000,000	8	6
Brain Out –Can you pass it? Package Name: com.mind.quiz.brain.out Version: 1.3.3 (133)	Focus apps	100,000,000	13	6
Slap Kings Package Name: mobi.gameguru.slapkings Version: 1.2.3 (17)	Lion Studios	50,000,000	12	6
My Home - Design Dreams Package Name: com.spacegame.homedesign Version: 1.0.219 (91)	Zentertain	50,000,000	14	6
Matchington Mansion Package Name: com.matchington.mansion Version: 1.68.0 (323)	Firecraft Studios	50,000,000	11	6
CodyCross: Crossword Puzzles Package Name: com.fanatee.cody Version: 1.37.1 (132)	Fanatee, Inc.	50,000,000	11	6
Art of War: Legions Package Name: com.addictive.strategy.army Version: 2.9.2 (292)	10P STUDIO	10,000,000	11	6
Merge Dragons! Package Name: com.gramgames.mergedragons Version: 4.10.0 (457)	Gram Games Limited	10,000,000	11	6

(Table Continues)

Table 53 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Bleacher Report: sports news, scores, & highlights Package Name: com.bleacherreport.android.teamstream Version: 7.16.0 (8368)	Bleacher Report Inc.	10,000,000	8	6
Paint by Number - Pixel Art, Free Coloring Book Package Name: sandbox.pixel.number.coloring.book.page.art.free Version: 3.18.3 (126)	Beetles Games Studio	10,000,000	12	6
Scrabble® GO - New Word Game Package Name: com.pieyel.scrabble Version: 1.22.0 (1220000175)	Scopely	5,000,000	14	6
AFL Live Official App Package Name: com.telstra.android.afl Version: 06.02.40877 (40877)	Telstra Corporation Ltd.	1,000,000	7	6
Slots Casino - Jackpot Mania Package Name: slots.hot.vegas.casino.games.free Version: 1.77.0 (292)	Grande Games	1,000,000	8	6
Bible Coloring - Paint by Number, Free Bible Games Package Name: holy.bible.biblegame.bibleverse.color.by.number.colorbynumber.paint.pixel.art Version: 2.1.5 (205)	iDailybread.org	1,000,000	9	6
My Talking Tom Friends Package Name: com.outfit7.mytalkingtomfriends Version: 1.0.5.1451 (60)	Outfit7 Limited	1,000,000	9	6
Football Management Ultra 2020 - Manager Game Package Name: com.trophymanager.ultra Version: 2.1.34 (20134)	Trophy Games - Football Manager Game Makers	1,000,000	14	6
European War 6: 1804 Package Name: com.easytech.android.ew6 Version: 1.2.20 (15)	EasyTech	1,000,000	9	6
Cash Mania Slots - Free Slots Casino Games Package Name: slots.free.vegas.casino.cash.mania Version: 1.25 (125)	Galaxy Entertainment Limited	500,000	7	6
World Poker Tour - PlayWPT Free Texas Holdem Poker Package Name: com.playwpt.mobile.poker Version: 19.9.95 (51)	CaptivePlay	100,000	9	6
Sportfusion - Unofficial News for Liverpool Package Name: com.sportstream.premier.liverpool Version: 3.953 (6323)	SportFusion	10,000	6	6
Slots: Heart of Vegas™ -Free Slot Casino Games Package Name: com.productmadness.hovmobile Version: 4.16.40 (4017012)	Product Madness	10,000,000	10	5
House of Fun™ : Free Slots & Casino Games Package Name: com.pacificinteractive.HouseOfFun	PLAYTIKA UK - HOUSE OF FUN LIMITED	10,000,000	6	5

(Table Continues)

Table 53 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Version: 3.57 (1133) ESPNcricinfo - Live Cricket Scores, News & Videos Package Name: com.july.cricinfo Version: 6.21.1 (8429)	ESPN Inc	10,000,000	7	5
Parkour Race - Freerun Game Package Name: com.parkourrace.game Version: 1.6.0 (1060004)	Madbox	10,000,000	17	5
Cashman Casino: Vegas Slot Machines! 2M Free! Package Name: com.productmadness.cashmancasino Version: 2.25.70 (10103354)	Product Madness	5,000,000	10	5
The Seven Deadly Sins: Grand Cross Package Name: com.netmarble.nanagb Version: 1.0.9 (65010009)	Netmarble	5,000,000	12	5
Lightning Link Casino: Free Vegas Slots! 10M Bonus Package Name: com.productmadness.lightninglink Version: 5.6.0 (5006000)	Product Madness	1,000,000	12	5
NRL Official App Package Name: com.telstra.nrl Version: 4.5.2 (1714452)	Telstra Digital Media	1,000,000	5	5
Jewel Blast Dragon - Match 3 Puzzle Package Name: com.go7game.jewelclassic Version: 1.15.3 (163)	Go7Game	100,000	11	5
Cash Hunter Casino -Free Vegas Slot Machine Package Name: vegas.slots.cash.hunter.free.bonus.casino Version: 1.00.06 (10006)	Seven Slots Tech - Free Jackpot Slots Casino	10,000	8	5
Sudoku. Logic Puzzle Package Name: com.forsbit.sudoku Version: 1.1.2 (39)	Forsbit LLC	10,000	8	5
Homescapes Package Name: com.playrix.homescapes Version: 3.5.9 (1000359)	Playrix	100,000,000	4	4
Mobile Legends: Bang Bang Package Name: com.mobile.legends Version: 1.4.76.5172 (14765172)	Moonton	100,000,000	4	4
Toon Blast Package Name: net.peakgames.toonblast Version: 5075 (105075)	Peak	50,000,000	4	4
Toy Blast Package Name: net.peakgames.amy Version: 7173 (717300)	Peak	50,000,000	5	4
Wood Block Puzzle - Free Classic Block Puzzle Game	Beetles Games Studio (Table Continues)	10,000,000	9	4

Table 53 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Package Name: puzzle.blockpuzzle.cube.relax Version: 1.7.3 (76)				
Tongits Go - The Best Card Game Online Package Name: com.tongitsgo.play Version: 2.9.6 (296)	Play Joy	5,000,000	5	4
Cricket Australia Live Package Name: au.com.cricket Version: 5.15.0 (17700625)	Cricket Australia	1,000,000	5	4
Slot Bonanza - Free casino slot machine game 777 Package Name: com.infiapps.slotbonanza Version: 2.322 (3183)	Joyvoo LTD	1,000,000	4	4
Kingdom Story: Brave Legion Package Name: com.nhent.SK10392 Version: 2.50.3.KG (20842)	NHN Corp.	1,000,000	5	4
Frog City Simulator Package Name: com.hgsphyscs.frogcity Version: 1.0 (6)	BalanMirelaAPP	50,000	11	4
8 Ball Pool Package Name: com.miniclip.eightballpool Version: 4.8.5 (2238)	Miniclip.com	500,000,000	3	3
PUBG MOBILE - Mad Miramar Package Name: com.tencent.ig Version: 0.18.0 (12600)	Tencent Games	100,000,000	3	3
Township Package Name: com.playrix.township Version: 7.5.0 (1007501)	Playrix	100,000,000	3	3
Cookie Jam™ Match 3 Games Connect 3 or More Package Name: air.com.sgn.cookiejam.gp Version: 10.20.011 (1010020011)	Jam City, Inc.	50,000,000	3	3
RAID: Shadow Legends Package Name: com.plarium.raidlegends Version: 1.15.2 (16264)	Plarium Global Ltd	10,000,000	4	3
Board Kings™ Package Name: com.jellybtn.boardkings Version: 3.22.0 (784)	Jelly Button Games	10,000,000	4	3
Empires & Puzzles: Epic Match 3 Package Name: com.smallgiantgames.empires Version: 29.0.1 (1270)	Small Giant Games	10,000,000	6	3
DoubleU Casino - Free Slots Package Name: com.doubleugames.DoubleUCasino Version: 6.26.2 (359)	DoubleUGames	10,000,000	3	3

(Table Continues)

Table 53 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Solitaire - Grand Harvest - Tripeaks Package Name: net.supertreat.solitaire Version: 1.63.0 (148)	Supertreat	10,000,000	4	3
Lily's Garden Package Name: dk.tactile.lilysgarden Version: 1.62.2 (195471)	Tactile Games	10,000,000	5	3
Yahoo Fantasy Sports - #1 Rated Fantasy App Package Name: com.yahoo.mobile.client.android.fantasyfootball Version: 10.17.2 (1300015063)	Yahoo	5,000,000	10	3
BLEACH Brave Souls - 3D Action Package Name: com.klab.bleach Version: 10.0.3 (143)	KLab	5,000,000	4	3
Superb Casino - HD Free Slots Games Package Name: com.uphill.slot.classic Version: 1.0.44 (58)	SuperB Casino	1,000,000	3	3
ZOOKEEPER BATTLE Package Name: jp.kiteretsu.zookeeperbattle.google Version: 4.9.0 (174)	KITERETSU inc.	1,000,000	3	3
FUT 20 Draft, Squad Builder & SBC - FUTBIN Package Name: com.futbin Version: 7.42 (154)	FUTBIN	1,000,000	4	3
Vegas Friends - Casino Slots for Free Package Name: com.funtriolimited.slots.casino.free Version: 1.0.006 (37)	Grande Games	500,000	4	3
Gaydorado Package Name: com.starg.rainbow Version: 1.20.1 (57)	CocoBear	500,000	5	3
Vegas Night Slots - HOT&FREE VEGAS CASINO GAMES Package Name: com.vegas.casino.slothbunm Version: 1.0.20 (20)	Zengzhineng	100,000	3	3
Ahri RPG Package Name: com.DoomsdayStudio.AhriRPG Version: 2.1 (39)	DOOMSDAY Studio	100,000	6	3
Spider Solitaire - Offline Free Card Games Package Name: com.sngict.spider Version: 2.1.1 (4028)	SNG Games	100,000	3	3
Casino Slots: Vegas Fever Package Name: casino.slots.vegasfever Version: 1.0.0.3 (27)	AGS Interactive	100,000	5	3
Ludo Bing Package Name: com.dotfinger.ludo.free	DotFinger Games	100,000	7	3

(Table Continues)

Table 53 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Version: 2.1.2 (25) 仙-中第一仙手游 Package Name: com.pwr.d.zxintscn Version: 1.790.0 (17901)	Perfect Game Speed	100,000	5	3
Cross Boss Package Name: com.kepgames.crossboss.android Version: 1.7.20 (340)	KEP Games AB	100,000	3	3
Pokémon GO Package Name: com.nianticlabs.pokemongo Version: 0.173.2 (2020042001)	Niantic, Inc.	100,000,000	2	2
Roblox Package Name: com.roblox.client Version: 2.431.404520 (729)	Roblox Corporation	100,000,000	3	2
Dragon City Package Name: es.socialpoint.DragonCity Version: 9.14.1 (1804791765)	Socialpoint	100,000,000	2	2
The Simpsons™: Tapped Out Package Name: com.ea.game.simpsons4_row Version: 4.44.0 (440)	ELECTRONIC ARTS	100,000,000	2	2
Clash Royale Package Name: com.supercell.clashroyale Version: 3.2.4 (448)	Supercell	100,000,000	2	2
Bricks Breaker Quest Package Name: com.mobirix.swipebrick2 Version: 1.0.78 (20051201)	mobirix	50,000,000	3	2
Zynga Poker –Free Texas Holdem Online Card Games Package Name: com.zynga.livepoker Version: 21.92 (10121920)	Zynga	50,000,000	3	2
Slotomania™ Slots Casino: Slot Machine Games Package Name: air.com.playtika.slotomania Version: 6.1.4 (601000041)	Playtika	50,000,000	2	2
Episode - Choose Your Story Package Name: com.episodeinteractive.android.catalog Version: 12.60.2 (1260021)	Episode Interactive	50,000,000	2	2
Summoners War Package Name: com.com2us.smon.normal.freefull.google.kr.android.common Version: 5.3.3 (53300)	Com2uS	50,000,000	2	2
Soccer Scores - FotMob Package Name: com.mobilefootie.wc2010 Version: 114.0.7808.20200403 (7808)	NorApps AS	10,000,000	3	2
Caesars Casino: Free Slots Games	Playtika (Table Continues)	10,000,000	2	2

Table 53 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Package Name: com.playtika.caesarscasino Version: 3.54.1 (35410011)				
Slots Pharaoh's Way Casino Games & Slot Machine Package Name: com.cervomedia.spw Version: 8.0.3 (80003)	Funstage	10,000,000	2	2
Bingo Blitz™ - Bingo Games Package Name: air.com.buffalo_studios.newflashbingo Version: 4.40.0 (40400034)	Playtika Santa Monica	10,000,000	2	2
Lotsa Slots - Free Vegas Casino Slot Machines Package Name: com.diamondlife.slots.vegas.free Version: 3.84 (384)	Grande Games	5,000,000	2	2
Fire Emblem Heroes Package Name: com.nintendo.zaba Version: 4.5.0 (529623)	Nintendo Co., Ltd.	5,000,000	2	2
Fortnite Package Name: com.epicgames.fortnite Version: 13.00.0-13649811-Android (13649811)	Epic Games, Inc	5,000,000	3	2
Guardian Soul Package Name: com.mobirix.gs2016 Version: 1.5.4 (156)	mobirix	1,000,000	3	2
Kayo Sports Package Name: au.com.kayosports Version: 1.2.5 (1020005)	Streamotion Pty Ltd	100,000	3	2
Game of Words: Free Word Games & Puzzles Package Name: com.TinyBit.GameOfWords Version: 1.27.0 (141)	DreamLoff	100,000	2	2
Raid the Dungeon : Idle RPG Heroes AFK or Tap Tap Package Name: kr.co.questgames.druwadungeonag Version: 1.2.5 (54)	Quest Games Co., Ltd.	100,000	6	2
Candy Crush Saga Package Name: com.king.candycrushsaga Version: 1.176.0.2 (11760021)	King	1,000,000,000	1	1
Clash of Clans Package Name: com.supercell.clashofclans Version: 13.180.16 (1233)	Supercell	500,000,000	1	1
Call of Duty®: Mobile Package Name: com.activision.callofduty.shooter Version: 1.0.12 (679)	Activision Publishing, Inc.	100,000,000	1	1
Farm Heroes Saga Package Name: com.king.farmheroessaga Version: 5.37.5 (330041)	King	100,000,000	1	1

(Table Continues)

Table 53 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Candy Crush Soda Saga Package Name: com.king.candycrushsodasaga Version: 1.168.2 (11681020)	King	100,000,000	1	1
Marvel Contest of Champions Package Name: com.kabam.marvelbattle Version: 27.0.0 (101237901)	Kabam Games, Inc.	100,000,000	1	1
Candy Crush Friends Saga Package Name: com.king.candycrush4 Version: 1.37.4 (2037104)	King	10,000,000	1	1
LiveScore: Live Sport Updates Package Name: com.livescore Version: 3.2.1 (116)	LiveScore Ltd.	10,000,000	1	1
Chess -Play & Learn Package Name: com.chess Version: 4.1.1 (21875)	Chess.com	10,000,000	1	1
Forge of Empires Package Name: com.innogames.foeandroid Version: 1.177.1 (446)	InnoGames GmbH	10,000,000	1	1
DRAGON BALL LEGENDS Package Name: com.bandainamcoent.dblegends_ww Version: 2.7.0 (146)	BANDAI NAMCO Entertainment Inc.	10,000,000	2	1
Arknights Package Name: com.YoStarEN.Arknights Version: 0.8.14 (39)	Yostar Limited.	1,000,000	2	1
Azur Lane Package Name: com.YoStarEN.AzurLane Version: 3.1.15 (3115)	Yostar Limited.	1,000,000	2	1
BBC Sport Package Name: bbc.mobile.sport.ww Version: 1.26.2.4 (10037322)	BBC Worldwide (Ltd)	1,000,000	1	1
Alien Shooter TD Package Name: com.sigmateam.alienshooter.towerdefence Version: 1.6.4 (61)	Sigma Team	500,000	1	1
Block Puzzle 2020 Package Name: com.re.blockpuzzleclassic Version: 1.0 (5)	Replay Entertainment	1,000	3	1
Brawl Stars Package Name: com.supercell.brawlstars Version: 26.184 (116)	Supercell	100,000,000	0	0
Hay Day Package Name: com.supercell.hayday	Supercell	100,000,000	0	0

(Table Continues)

Table 53 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Version: 1_45_111 (1616) Boom Beach Package Name: com.supercell.boombeach Version: 40.93 (40093)	Supercell	50,000,000	0	0
Gacha Life Package Name: air.com.lunime.gachalife Version: 1.1.4 (1001004)	Lunime	10,000,000	0	0
Klondike Adventures Package Name: com.vizorapps.klondike Version: 1.64 (373)	VIZOR APPS LTD.	10,000,000	0	0
Animal Crossing: Pocket Camp Package Name: com.nintendo.zaca Version: 3.2.0 (23070)	Nintendo Co., Ltd.	10,000,000	0	0
Throne Rush Package Name: com.progrestar.bft Version: 5.20.0 (143452000)	NEXTERS GLOBAL LTD	10,000,000	0	0
Mahjong Package Name: net.game.mahjong Version: 1.35 (135300)	1bsyl	5,000,000	0	0
SUDOKU - Free Games Package Name: com.kraisoft.sudoku Version: 1.1.512 (181)	Kraisoft	1,000,000	0	0
Material Sudoku Package Name: com.jdamcd.sudoku Version: 3.0-42 (42)	OkayCode	1,000,000	0	0
Epic Seven Package Name: com.stove.epic7.google Version: 1.0.238 (171000238)	Smilegate Megaport	1,000,000	0	0
Knighthood Package Name: com.king.knightsrage Version: 1.1.6 (187)	King	1,000,000	0	0
Antimatter Dimensions Package Name: kajfosz.antimatterdimensions Version: 2.23.1 (20230010)	Jakub Kajfosz	100,000	0	0
Words By Post Free Package Name: com.WordsByPostFree Version: 2.2.1 (34)	Games By Post	100,000	0	0
Solitaire suite - 25 in 1 Package Name: com.quarzo.solitairepack Version: 1.1.5 (115)	Quarzo Apps	100,000	0	0
Solitaire HD	Till Essers (Table Continues)	50,000	0	0

Table 53 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Package Name: de.heimlich.gut.solitaire.hd Version: 1.1.2 (5)				
Freecell in Nature Package Name: com.jellybrain.freecell Version: 3.22 (11)	doctor2jk	50,000	0	0

D.1.1.4 Popular Apps Transmitting Each Data Type

For each of these data types, Table 54 lists the top 5 most popular Games apps that we observed transmitting them during testing.¹⁰⁷

Table 54: The top 5 Games apps that we detected transmitting each data type during the testing period.

Data Type	Top 5 Apps	Developer	# of Installs
AAID	Candy Crush Saga (com.king.candycrushsaga), v1.176.0.2 (11760021)	King	1,000,000,000
	8 Ball Pool (com.miniclip.eightballpool), v4.8.5 (2238)	Miniclip.com	500,000,000
	Pokémon GO (com.nianticlabs.pokemongo), v0.173.2 (2020042001)	Niantic, Inc.	100,000,000
	Call of Duty®: Mobile (com.activision.callofduy.shooter), v1.0.12 (679)	Activision Publishing, Inc.	100,000,000
	Roblox (com.roblox.client), v2.431.404520 (729)	Roblox Corporation	100,000,000
Android ID	Clash of Clans (com.supercell.clashofclans), v13.180.16 (1233)	Supercell	500,000,000
	Pokémon GO (com.nianticlabs.pokemongo), v0.173.2 (2020042001)	Niantic, Inc.	100,000,000
	Roblox (com.roblox.client), v2.431.404520 (729)	Roblox Corporation	100,000,000
	Fishdom (com.playrix.fishdomdd.gplay), v4.82.0 (928048200)	Playrix	100,000,000
	Dragon City (es.socialpoint.DragonCity), v9.14.1 (1804791765)	Socialpoint	100,000,000
	Solitaire (com.mobilityware.solitaire), v6.5.0.3492 (3492)	MobilityWare	100,000,000
BT Name	Magic Tiles 3 (com.youmusic.magictiles), v7.063.006 (2006311912)	AMANOTES	100,000,000
	Brain Out –Can you pass it? (com.mind.quiz.brain.out), v1.3.3 (133)	Focus apps	100,000,000
	Pixel Art: Color by Number (com.europosit.pixelcoloring), v4.9 (1110049019)	Easybrain	50,000,000
	Happy Color™ –Color by Number (com.pixel.art.coloring.color.number), v2.8.3 (99)	X-Flow	50,000,000

(Table Continues)

¹⁰⁷Popularity is determined by the number of reported installs in the Google Play Store.

Table 54 (Continued)

Data Type	Top 5 Apps	Developer	# of Installs
WiFi MAC	Brain Out –Can you pass it? (com.mind.quiz.brain.out), v1.3.3 (133)	Focus apps	100,000,000
	Superb Casino - HD Free Slots Games (com.uphill.slot.classic), v1.0.44 (58)	SuperB Casino	1,000,000
	Vegas Night Slots - HOT&FREE VEGAS CASINO GAMES (com.vegas.casino.slothbunm), v1.0.20 (20)	Zengzhineng	100,000
	Jewel Blast Dragon - Match 3 Puzzle (com.go7game.jewelclassic), v1.15.3 (163)	Go7Game	100,000
	Cross Boss (com.kepgames.crossboss.android), v1.7.20 (340)	KEP Games AB	100,000
BT SSID	Tiles Hop: EDM Rush! (com.amanotes.beathopper), v3.1.9 (500148)	AMANOTES	100,000,000
	Sniper 3D: Fun Free Online FPS Shooting Game (com.fungames.sniper3d), v3.12.1 (6927)	Fun Games For Free	100,000,000
	Slots Casino - Jackpot Mania (slots.hot.vegas.casino.games.free), v1.77.0 (292)	Grande Games	1,000,000
	Cash Mania Slots - Free Slots Casino Games (slots.free.vegas.casino.cash.mania), v1.25 (125)	Galaxy Entertainment Limited	500,000
BT BSSID	Paint By Number - Free Coloring Book & Puzzle Game (paint.by.number.pixel.art.coloring.drawing.puzzle), v2.18.3 (1259)	Better Life - Color and Draw	50,000,000
	Double Win Casino Slots - Free Vegas Casino Games (com.huge.slots.casino.vegas.android.avidly), v1.46 (146)	Free Royal Slot Casino	1,000,000
	Spider Solitaire - Offline Free Card Games (com.sngict.spider), v2.1.1 (4028)	SNG Games	100,000
GPS Location	theScore: Live Sports Scores, News, Stats & Videos (com.fivemobile.thescore), v20.8.0 (20080)	theScore, Inc.	10,000,000
	Happy Wheels (com.fancyforce.happywheels), v1.0.6 (23)	James Bonacci	5,000,000
Coarse Location	theScore: Live Sports Scores, News, Stats & Videos (com.fivemobile.thescore), v20.8.0 (20080)	theScore, Inc.	10,000,000
	Happy Wheels (com.fancyforce.happywheels), v1.0.6 (23)	James Bonacci	5,000,000
GSF ID			

(Table Continues)

Table 54 (Continued)

Data Type	Top 5 Apps	Developer	# of Installs
	Fishdom (com.playrix.fishdomdd.gplay), v4.82.0 (928048200)	Playrix	100,000,000
Name	Tongits Go - The Best Card Game Online (com.tongitsgo.play), v2.9.6 (296)	Play Joy	5,000,000
Email	Tongits Go - The Best Card Game Online (com.tongitsgo.play), v2.9.6 (296)	Play Joy	5,000,000

Table 55 lists the 5 most popular Games apps that transmitted the most data types during the testing period, whereas Table 56 lists the 5 most popular Games apps that transmitted the fewest data types during the testing period.

Top 5 Apps	Developer	# of Installs	Data Types
Tongits Go - The Best Card Game Online (com.tongitsgo.play), v2.9.6 (296)	Play Joy	5,000,000	5
Brain Out –Can you pass it? (com.mind.quiz.brain.out), v1.3.3 (133)	Focus apps	100,000,000	4
theScore: Live Sports Scores, News, Stats & Videos (com.fivemobile.thescore), v20.8.0 (20080)	theScore, Inc.	10,000,000	4
Jewel Blast Dragon - Match 3 Puzzle (com.go7game.jewelclassic), v1.15.3 (163)	Go7Game	100,000	4
Fishdom (com.playrix.fishdomdd.gplay), v4.82.0 (928048200)	Playrix	100,000,000	3

Table 55: The top 5 Games apps that transmitted the most data types during testing.

Top 5 Apps	Developer	# of Installs	Data Types
Brawl Stars (com.supercell.brawlstars), v26.184 (116)	Supercell	100,000,000	0
Hay Day (com.supercell.hayday), v1_45_111 (1616)	Supercell	100,000,000	0
Boom Beach (com.supercell.boombeach), v40.93 (40093)	Supercell	50,000,000	0
Gacha Life (air.com.lunime.gachalife), v1.1.4 (1001004)	Lunime	10,000,000	0
Klondike Adventures (com.vizorapps.klondike), v1.64 (373)	VIZOR APPS LTD.	10,000,000	0

Table 56: The top 5 Games apps that transmitted the fewest data types during testing.

D.1.2 App Permissions

Apps in the Games category requested the dangerous permissions listed in Table 57.¹⁰⁸

Data Type	# of Apps	(% of Apps)
WRITE_EXTERNAL_STORAGE	106	(65.0%)
READ_EXTERNAL_STORAGE	91	(55.8%)
GET_ACCOUNTS	22	(13.5%)
READ_PHONE_STATE	21	(12.9%)
ACCESS_COARSE_LOCATION	20	(12.3%)
CAMERA	17	(10.4%)
ACCESS_FINE_LOCATION	17	(10.4%)
RECORD_AUDIO	12	(7.4%)
READ_CONTACTS	6	(3.7%)
WRITE_CALENDAR	2	(1.2%)
READ_CALENDAR	2	(1.2%)

Table 57: Dangerous permissions requested by apps in the Games category.

¹⁰⁸For an explanation of dangerous permissions, see Section 4.3.

D.1.2.1 Popular Apps Requesting Dangerous Permissions For each of these permissions, Table 58 lists the top 5 most popular apps that we observed requesting dangerous permissions during testing.¹⁰⁹

Table 58: The 5 most popular Games apps that requested each dangerous permission.

Permission	Top 5 Apps	Developer	# of Installs
WRITE_EXTERNAL_STORAGE	Clash of Clans (com.supercell.clashofclans), v13.180.16 (1233)	Supercell	500,000,000
	Pokémon GO (com.nianticlabs.pokemongo), v0.173.2 (2020042001)	Niantic, Inc.	100,000,000
	Call of Duty®: Mobile (com.activision.callofduty.shooter), v1.0.12 (679)	Activision Publishing, Inc.	100,000,000
	Fishdom (com.playrix.fishdomdd.gplay), v4.82.0 (928048200)	Playrix	100,000,000
	Brawl Stars (com.supercell.brawlstars), v26.184 (116)	Supercell	100,000,000
READ_EXTERNAL_STORAGE	Clash of Clans (com.supercell.clashofclans), v13.180.16 (1233)	Supercell	500,000,000
	Pokémon GO (com.nianticlabs.pokemongo), v0.173.2 (2020042001)	Niantic, Inc.	100,000,000
	Call of Duty®: Mobile (com.activision.callofduty.shooter), v1.0.12 (679)	Activision Publishing, Inc.	100,000,000
	Fishdom (com.playrix.fishdomdd.gplay), v4.82.0 (928048200)	Playrix	100,000,000
	Brawl Stars (com.supercell.brawlstars), v26.184 (116)	Supercell	100,000,000
GET_ACCOUNTS	Pokémon GO (com.nianticlabs.pokemongo), v0.173.2 (2020042001)	Niantic, Inc.	100,000,000
	Cricbuzz - Live Cricket Scores & News (com.cricbuzz.android), v4.6.005 (1521046005)	Cricbuzz.com	100,000,000
	Mobile Legends: Bang Bang (com.mobile.legends), v1.4.76.5172 (14765172)	Moonton	100,000,000
	Zynga Poker –Free Texas Holdem Online Card Games (com.zynga.livepoker), v21.92 (10121920)	Zynga	50,000,000
	Caesars Casino: Free Slots Games (com.playtika.caesarscasino), v3.54.1 (35410011)	Playtika	10,000,000
	READ_PHONE_STATE		

(Table Continues)

¹⁰⁹Popularity is determined by the number of reported installs in the Google Play Store.

Table 58 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	Mobile Legends: Bang Bang (com.mobile.legends), v1.4.76.5172 (14765172)	Moonton	100,000,000
	Zynga Poker –Free Texas Holdem Online Card Games (com.zynga.livepoker), v21.92 (10121920)	Zynga	50,000,000
	Slotomania™ Slots Casino: Slot Machine Games (air.com.playtika.slotomania), v6.1.4 (601000041)	Playtika	50,000,000
	Summoners War (com.com2us.smon.normal.freefull.google.kr.android.common), v5.3.3 (53300)	Com2uS	50,000,000
	Gacha Life (air.com.lunime.gachalife), v1.1.4 (1001004)	Lunime	10,000,000
ACCESS_COARSE_LOCATION			
	Pokémon GO (com.nianticlabs.pokemongo), v0.173.2 (2020042001)	Niantic, Inc.	100,000,000
	Cricbuzz - Live Cricket Scores & News (com.cricbuzz.android), v4.6.005 (1521046005)	Cricbuzz.com	100,000,000
	Mobile Legends: Bang Bang (com.mobile.legends), v1.4.76.5172 (14765172)	Moonton	100,000,000
	Slots Pharaoh's Way Casino Games & Slot Machine (com.cervomedia.spw), v8.0.3 (80003)	Funstage	10,000,000
	Bleacher Report: sports news, scores, & highlights (com.bleacherreport.android.teamstream), v7.16.0 (8368)	Bleacher Report Inc.	10,000,000
CAMERA			
	Pokémon GO (com.nianticlabs.pokemongo), v0.173.2 (2020042001)	Niantic, Inc.	100,000,000
	Mobile Legends: Bang Bang (com.mobile.legends), v1.4.76.5172 (14765172)	Moonton	100,000,000
	Clash Royale (com.supercell.clashroyale), v3.2.4 (448)	Supercell	100,000,000
	Pixel Art: Color by Number (com.europosit.pixelcoloring), v4.9 (1110049019)	Easybrain	50,000,000
	Boom Beach (com.supercell.boombeach), v40.93 (40093)	Supercell	50,000,000
ACCESS_FINE_LOCATION			
	Pokémon GO (com.nianticlabs.pokemongo), v0.173.2 (2020042001)	Niantic, Inc.	100,000,000
	Cricbuzz - Live Cricket Scores & News (com.cricbuzz.android), v4.6.005 (1521046005)	Cricbuzz.com	100,000,000
	Mobile Legends: Bang Bang (com.mobile.legends), v1.4.76.5172 (14765172)	Moonton	100,000,000
	Happy Color™ –Color by Number	X-Flow	50,000,000

(Table Continues)

Table 58 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(com.pixel.art.coloring.color.number), v2.8.3 (99) Slots Pharaoh's Way Casino Games & Slot Machine (com.cervomedia.spw), v8.0.3 (80003)	Funstage	10,000,000
RECORD_AUDIO			
	Call of Duty®: Mobile (com.activision.callofduty.shooter), v1.0.12 (679) My Talking Tom 2 (com.outfit7.mytalkingtom2), v2.0.1.962 (360) PUBG MOBILE - Mad Miramar (com.tencent.ig), v0.18.0 (12600) Mobile Legends: Bang Bang (com.mobile.legends), v1.4.76.5172 (14765172) Summoners War (com.com2us.smon.normal.freefull.google.kr.android.common), v5.3.3 (53300)	Activision Publishing, Inc. Outfit7 Limited Tencent Games Moonton Com2uS	100,000,000 100,000,000 100,000,000 100,000,000 50,000,000
READ_CONTACTS			
	Summoners War (com.com2us.smon.normal.freefull.google.kr.android.common), v5.3.3 (53300) Bleacher Report: sports news, scores, & highlights (com.bleacherreport.android.teamstream), v7.16.0 (8368) theScore: Live Sports Scores, News, Stats & Videos (com.fivemobile.thescore), v20.8.0 (20080) Scrabble® GO - New Word Game (com.pieyel.scrabble), v1.22.0 (1220000175) Tongits Go - The Best Card Game Online (com.tongitsgo.play), v2.9.6 (296)	Com2uS Bleacher Report Inc. theScore, Inc. Scopely Play Joy	50,000,000 10,000,000 10,000,000 5,000,000 5,000,000
WRITE_CALENDAR			
	Mobile Legends: Bang Bang (com.mobile.legends), v1.4.76.5172 (14765172) theScore: Live Sports Scores, News, Stats & Videos (com.fivemobile.thescore), v20.8.0 (20080)	Moonton theScore, Inc.	100,000,000 10,000,000
READ_CALENDAR			
	Mobile Legends: Bang Bang (com.mobile.legends), v1.4.76.5172 (14765172) theScore: Live Sports Scores, News, Stats & Videos (com.fivemobile.thescore), v20.8.0 (20080)	Moonton theScore, Inc.	100,000,000 10,000,000

Table 59 lists the 5 most popular Games apps that requested the most permissions, whereas Table 60 lists the 5 most popular Games apps that requested the fewest permissions.

Top 5 Apps	Developer	# of Installs	Permissions
Mobile Legends: Bang Bang (com.mobile.legends), v1.4.76.5172 (14765172)	Moonton	100,000,000	25
NRL Official App (com.telstra.nrl), v4.5.2 (1714452)	Telstra Digital Media	1,000,000	22
Tongits Go - The Best Card Game Online (com.tongitsgo.play), v2.9.6 (296)	Play Joy	5,000,000	17
Pokémon GO (com.nianticlabs.pokemongo), v0.173.2 (2020042001)	Niantic, Inc.	100,000,000	16
theScore: Live Sports Scores, News, Stats & Videos (com.fivemobile.thescore), v20.8.0 (20080)	theScore, Inc.	10,000,000	16

Table 59: The 5 most popular Games apps that requested the most permissions.

Top 5 Apps	Developer	# of Installs	Permissions
Material Sudoku (com.jdamcd.sudoku), v3.0-42 (42)	OkayCode	1,000,000	0
Solitaire HD (de.heimlich.gut.solitaire.hd), v1.1.2 (5)	Till Essers	50,000	2
Block Puzzle 2020 (com.re.blockpuzzleclassic), v1.0 (5)	Replay Entertainment	1,000	2
Mahjong (net.game.mahjong), v1.35 (135300)	lbsyl	5,000,000	3
TOP SEED Tennis: Sports Management Simulation Game (com.gaminho.topseedtennis), v2.42.7 (2042007000)	Gaminho	1,000,000	3

Table 60: The 5 most popular Games apps that requested the least number of permissions.

D.1.2.2 Permission Usage While the previous subsection depicted the dangerous permissions *requested* by the apps that were tested, Table 61 lists the Games apps based on the dangerous permissions that were observed being *used* during the testing period.

Table 61: Games apps based on total number of permissions requested, the number of those that are considered “dangerous,” and the percentage of those dangerous permissions that were used during testing.

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
Mobile Legends: Bang Bang (com.mobile.legends), v1.4.76.5172 (14765172)	Moonton	25	10	0.0
NRL Official App (com.telstra.nrl), v4.5.2 (1714452)	Telstra Digital Media	22	8	0.0
Tongits Go - The Best Card Game Online (com.tongitsgo.play), v2.9.6 (296)	Play Joy	17	8	0.0
Pokémon GO (com.nianticlabs.pokemongo), v0.173.2 (2020042001)	Niantic, Inc.	16	6	0.0
Slots Casino - Jackpot Mania (slots.hot.vegas.casino.games.free), v1.77.0 (292)	Grande Games	16	6	0.0
Cricket Australia Live (au.com.cricket), v5.15.0 (17700625)	Cricket Australia	16	5	0.0
Yahoo Fantasy Sports - #1 Rated Fantasy App (com.yahoo.mobile.client.android.fantasyfootball), v10.17.2 (1300015063)	Yahoo	16	6	0.0
Lucky Time - Win Your Lucky Day & Real Money (playgame.realmoney.free.scratchers.win.luckytime), v1.3.46 (103046)	Luckytime App Team	16	6	0.0
AFL Live Official App (com.telstra.android.afl), v06.02.40877 (40877)	Telstra Corporation Ltd.	16	6	16.7
theScore: Live Sports Scores, News, Stats & Videos (com.fivemobile.thescore), v20.8.0 (20080)	theScore, Inc.	16	9	22.2
Summoners War (com.com2us.smon.normal.freefull.google.kr.android.common), v5.3.3 (53300)	Com2uS	15	5	20.0
PUBG MOBILE - Mad Miramar (com.tencent.ig), v0.18.0 (12600)	Tencent Games	14	3	0.0
ESPNCricinfo - Live Cricket Scores, News & Videos (com.july.cricinfo), v6.21.1 (8429)	ESPN Inc	14	4	25.0
Kingdom Story: Brave Legion (com.nhnent.SK10392), v2.50.3.KG (20842)	NHN Corp.	14	3	33.3
Bible Coloring - Paint by Number, Free Bible Games (com.dailybread.org)	iDailybread.org	13	3	0.0

(Table Continues)

Table 61 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(holy.bible.biblegame.bibleverse.color.by.number.colorbynumber.paint.pixel.art), v2.1.5 (205)				
Gaydorado (com.starg.rainbow), v1.20.1 (57)	CocoBear	13	4	0.0
Paint by Number - Pixel Art, Free Coloring Book (sandbox.pixel.number.coloring.book.page.art.free), v3.18.3 (126)	Beetles Games Studio	13	4	25.0
Slots Pharaoh's Way Casino Games & Slot Machine (com.cervomedia.spw), v8.0.3 (80003)	Funstage	13	5	40.0
Words With Friends 2 -Free Word Games & Puzzles (com.zynga.words3), v14.521 (14521)	Zynga	12	3	0.0
World Poker Tour - PlayWPT Free Texas Holdem Poker (com.playwpt.mobile.poker), v19.9.95 (51)	CaptivePlay	12	4	0.0
Words With Friends -Word Puzzle (com.zynga.wwf2.free), v14.521 (14521)	Zynga	12	3	0.0
Gold Fortune Casino™ - Free Vegas Slots (triwins.casino.slots.fortune.gold), v5.3.0.151 (151)	TRIWINS	12	2	0.0
Call of Duty®: Mobile (com.activision.callofduty.shooter), v1.0.12 (679)	Activision Publishing, Inc.	11	3	0.0
Cricbuzz - Live Cricket Scores & News (com.cricbuzz.android), v4.6.005 (1521046005)	Cricbuzz.com	11	5	0.0
Bleacher Report: sports news, scores, & highlights (com.bleacherreport.android.teamstream), v7.16.0 (8368)	Bleacher Report Inc.	11	4	0.0
DoubleU Casino - Free Slots (com.doubleugames.DoubleUCasino), v6.26.2 (359)	DoubleUGames	11	5	0.0
Slot Bonanza - Free casino slot machine game 777 (com.infiapps.slotbonanza), v2.322 (3183)	Joyvoo LTD	11	4	0.0
Lotsa Slots - Free Vegas Casino Slot Machines (com.diamondlife.slots.vegas.free), v3.84 (384)	Grande Games	10	2	0.0
Slotomania™ Slots Casino: Slot Machine Games (air.com.playtika.slotomania), v6.1.4 (601000041)	Playtika	10	2	0.0
House of Fun™ : Free Slots & Casino Games (com.pacificinteractive.HouseOfFun), v3.57 (1133)	PLAYTIKA UK - HOUSE OF FUN LIMITED	10	0	0.0
Lily's Garden (dk.factile.lilysgarden), v1.62.2 (195471)	Tactile Games	10	2	0.0
Azur Lane (com.YoStarEN.AzurLane), v3.1.15 (3115)	Yostar Limited.	10	4	0.0
Covet Fashion - Dress Up Game (com.crowdstar.covetfashion), v20.04.202 (2020050602)	Crowdstar Inc	10	4	0.0

(Table Continues)

Table 61 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
The Seven Deadly Sins: Grand Cross (com.netmarble.nanagb), v1.0.9 (65010009)	Netmarble	10	2	0.0
Voetbalzone (com.nakko.android.voetbalzone), v3.0.2 (3024)	Voetbalzone B.V.	10	4	0.0
FUT 20 Draft, Squad Builder & SBC - FUTBIN (com.futbin), v7.42 (154)	FUTBIN	10	2	0.0
Fortnite (com.epicgames.fortnite), v13.00.0-13649811-Android (13649811)	Epic Games, Inc	10	1	0.0
Soccer Scores - FotMob (com.mobilefootie.wc2010), v114.0.7808.20200403 (7808)	NorApps AS	9	2	0.0
Caesars Casino: Free Slots Games (com.playtika.caesarscasino), v3.54.1 (35410011)	Playtika	9	3	0.0
Vegas Night Slots - HOT&FREE VEGAS CASINO GAMES (com.vegas.casino.slothbunm), v1.0.20 (20)	Zengzhineng	9	1	0.0
Toy Blast (net.peakgames.amy), v7173 (717300)	Peak	9	2	0.0
Superb Casino - HD Free Slots Games (com.uphill.slot.classic), v1.0.44 (58)	SuperB Casino	9	1	0.0
Nonogram.com - Picture cross puzzle game (com.easybrain.nonogram), v2.1.0 (21012)	Easybrain	9	2	0.0
BLEACH Brave Souls - 3D Action (com.klab.bleach), v10.0.3 (143)	KLab	9	2	0.0
Lucky Time - Win Rewards Every Day (com.luckyapp.winner), v3.1.54 (54)	Lucky Lucky Team	9	2	0.0
BBC Sport (bbc.mobile.sport.ww), v1.26.2.4 (10037322)	BBC Worldwide (Ltd)	9	3	0.0
DRAGON BALL LEGENDS (com.bandainamcoent.dblegends_ww), v2.7.0 (146)	BANDAI NAMCO Entertainment Inc.	9	3	0.0
Raid the Dungeon : Idle RPG Heroes AFK or Tap Tap (kr.co.questgames.druwadungeonag), v1.2.5 (54)	Quest Games Co., Ltd.	9	2	0.0
Sharpen Blade (com.zplay.blade), v1.21.0 (18)	ZPLAY Games	9	3	0.0
Clash Royale (com.supercell.clashroyale), v3.2.4 (448)	Supercell	9	3	0.0
Paint By Number - Free Coloring Book & Puzzle Game (paint.by.number.pixel.art.coloring.drawing.puzzle), v2.18.3 (1259)	Better Life - Color and Draw	9	2	0.0
Idle Miner Tycoon: Mine & Money Clicker Management (Table Continues)	Kolibri Games	9	2	0.0

Table 61 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(com.fluffyfairygames.idleminertycoon), v3.02.0 (43265)				
Fishdom (com.playrix.fishdomdd.gplay), v4.82.0 (928048200)	Playrix	8	2	0.0
Brawl Stars (com.supercell.brawlstars), v26.184 (116)	Supercell	8	2	0.0
BlockuDoku - Block Puzzle Game (com.easybrain.block.puzzle.games), v1.3.0 (13009)	Easybrain	8	2	0.0
Pixel Art: Color by Number (com.europosit.pixelcoloring), v4.9 (1110049019)	Easybrain	8	3	0.0
Clash of Clans (com.supercell.clashofclans), v13.180.16 (1233)	Supercell	8	2	0.0
Lightning Link Casino: Free Vegas Slots! 10M Bonus (com.productmadness.lightninglink), v5.6.0 (5006000)	Product Madness	8	2	0.0
Zynga Poker -Free Texas Holdem Online Card Games (com.zynga.livepoker), v21.92 (10121920)	Zynga	8	3	0.0
Happy Color™ -Color by Number (com.pixel.art.coloring.color.number), v2.8.3 (99)	X-Flow	8	3	0.0
Chess -Play & Learn (com.chess), v4.1.1 (21875)	Chess.com	8	2	0.0
Cash Storm Casino - Online Vegas Slots Games (com.cashstorm.slots), v1.2.5 (125)	TRIWIN	8	1	0.0
Happy Wheels (com.fancyforce.happywheels), v1.0.6 (23)	James Bonacci	8	3	0.0
Slot Machines -Slots of Immortality™ Free Pokies (com.bi.slots.immortality), v1.46.3 (3003)	Bad Ibis Games Ltd	8	3	0.0
ZOOKEEPER BATTLE (jp.kiteretsu.zookeeperbattle.google), v4.9.0 (174)	KITERETSU inc.	8	2	0.0
Frog City Simulator (com.hgsphyscs.frogcity), v1.0 (6)	BalanMirelaAPP	8	0	0.0
□仙-中□第一□手□游 (com.pwr.d.zintscn), v1.790.0 (17901)	Perfect Game Speed	8	3	0.0
Tycoon Casino™: Free Vegas Jackpot Slots (com.tw.tycoon.casino), v1.5.2 (152)	Triwin Games	8	0	0.0
Boom Beach (com.supercell.boombeach), v40.93 (40093)	Supercell	8	3	0.0
Jigsaw Puzzles - Puzzle Game (com.easybrain.jigsaw.puzzles), v1.5.0 (15005)	Easybrain	8	2	0.0
European War 6: 1804 (Table Continues)	EasyTech	8	3	0.0

Table 61 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(com.easytech.android.ew6), v1.2.20 (15)				
Solitaire (com.tripledot.solitaire), v2.5.0 (236)	Tripledote Studios Limited	8	1	0.0
Cash Mania Slots - Free Slots Casino Games (slots.free.vegas.casino.cash.mania), v1.25 (125)	Galaxy Entertainment Limited	8	1	0.0
Tiles Hop: EDM Rush! (com.amanotes.beathopper), v3.1.9 (500148)	AMANOTES	8	2	0.0
Sniper 3D: Fun Free Online FPS Shooting Game (com.fungames.sniper3d), v3.12.1 (6927)	Fun Games For Free	8	2	0.0
Brain Test: Tricky Puzzles (com.unicostudio.brainetest), v2.653 (141)	Unico Studio	8	2	0.0
Dragon City (es.socialpoint.DragonCity), v9.14.1 (1804791765)	Socialpoint	7	2	0.0
Board Kings™ (com.jellybtn.boardkings), v3.22.0 (784)	Jelly Button Games	7	2	0.0
Hay Day (com.supercell.hayday), v1_45_111 (1616)	Supercell	7	2	0.0
Slots: Heart of Vegas™ -Free Slot Casino Games (com.productmadness.hovmobile), v4.16.40 (4017012)	Product Madness	7	1	0.0
Cashman Casino: Vegas Slot Machines! 2M Free! (com.productmadness.cashmancasino), v2.25.70 (10103354)	Product Madness	7	1	0.0
Homescapes (com.playrix.homescapes), v3.5.9 (1000359)	Playrix	7	2	0.0
Township (com.playrix.township), v7.5.0 (1007501)	Playrix	7	2	0.0
Toon Blast (net.peakgames.toonblast), v5075 (105075)	Peak	7	0	0.0
Sudoku.com - Free Sudoku Puzzles (com.easybrain.sudoku.android), v2.7.0 (27001)	Easybrain	7	2	0.0
Double Win Casino Slots - Free Vegas Casino Games (com.huge.slots.casino.vegas.android.avidly), v1.46 (146)	Free Royal Slot Casino	7	0	0.0
ESPN Fantasy Sports (com.espn.fantasy.lm.football), v7.2.0 (565)	ESPN Inc	7	1	0.0
Arknights (com.YoStarEN.Arknights), v0.8.14 (39)	Yostar Limited.	7	2	0.0
Scrabble® GO - New Word Game (com.pieyel.scrabble), v1.22.0 (1220000175)	Scopely	7	3	0.0
Sudoku. Logic Puzzle	Forsbit LLC	7	0	0.0

(Table Continues)

Table 61 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(com.forsbit.sudoku), v1.1.2 (39)				
Guardian Soul (com.mobirix.gs2016), v1.5.4 (156)	mobirix	7	2	0.0
Alien Shooter TD (com.sigmateam.alienshooter.towerdefence), v1.6.4 (61)	Sigma Team	7	1	0.0
Epic Seven (com.stove.epic7.google), v1.0.238 (171000238)	Smilegate Megaport	7	2	0.0
Parkour Race - Freerun Game (com.parkourrace.game), v1.6.0 (1060004)	Madbox	7	1	0.0
Marvel Contest of Champions (com.kabam.marvelbattle), v27.0.0 (101237901)	Kabam Games, Inc.	7	0	0.0
Cross Boss (com.kepgames.crossboss.android), v1.7.20 (340)	KEP Games AB	7	2	0.0
Wood Block Puzzle - Free Classic Block Puzzle Game (puzzle.blockpuzzle.cube.relax), v1.7.3 (76)	Beetles Games Studio	7	1	0.0
The Simpsons™: Tapped Out (com.ea.game.simpsons4_row), v4.44.0 (440)	ELECTRONIC ARTS	7	2	0.0
Magic Tiles 3 (com.youmusic.magictiles), v7.063.006 (2006311912)	AMANOTES	7	0	0.0
Johnny Trigger (com.time.trigger), v1.8.6 (29)	SayGames	7	2	0.0
Jewel Blast Dragon - Match 3 Puzzle (com.go7game.jewelclassic), v1.15.3 (163)	Go7Game	7	2	50.0
Roblox (com.roblox.client), v2.431.404520 (729)	Roblox Corporation	6	0	0.0
Spider Solitaire (com.mobilityware.spider), v5.5.3.3493 (3493)	MobilityWare	6	2	0.0
My Talking Tom 2 (com.outfit7.mytalkingtomb2), v2.0.1.962 (360)	Outfit7 Limited	6	1	0.0
Onefootball - Soccer Scores (de.motain.iliga), v12.9.1.8034 (1012099034)	Onefootball GmbH	6	0	0.0
Kayo Sports (au.com.kayosports), v1.2.5 (1020005)	Streamotion Pty Ltd	6	2	0.0
Solitaire (com.mobilityware.solitaire), v6.5.0.3492 (3492)	MobilityWare	6	2	0.0
LiveScore: Live Sport Updates (com.livescore), v3.2.1 (116)	LiveScore Ltd.	6	0	0.0
FreeCell Solitaire	MobilityWare	6	2	0.0

(Table Continues)

Table 61 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(com.mobilityware.freecell), v5.3.3.3332 (3332)				
Episode - Choose Your Story (com.episodeinteractive.android.catalog), v12.60.2 (1260021)	Episode Interactive	6	0	0.0
Solitaire - Grand Harvest - Tripeaks (net.supertreat.solitaire), v1.63.0 (148)	Supertreat	6	2	0.0
Bingo Blitz™ - Bingo Games (air.com.buffalo_studios.newflashbingo), v4.40.0 (40400034)	Playtika Santa Monica	6	0	0.0
Klondike Adventures (com.vizorapps.klondike), v1.64 (373)	VIZOR APPS LTD.	6	3	0.0
Animal Crossing: Pocket Camp (com.nintendo.zaca), v3.2.0 (23070)	Nintendo Co., Ltd.	6	2	0.0
Forge of Empires (com.innogames.foeandroid), v1.177.1 (446)	InnoGames GmbH	6	0	0.0
Word Expert (com.pisanu.scrabbleexpert.free), v4.3 (82)	Pisanu Chaloeprattanaorn	6	2	0.0
My Talking Tom Friends (com.outfit7.mytalkingtomfriends), v1.0.5.1451 (60)	Outfit7 Limited	6	1	0.0
Vegas Friends - Casino Slots for Free (com.funtrilimited.slots.casino.free), v1.0.006 (37)	Grande Games	6	2	0.0
Throne Rush (com.progrestart.bft), v5.20.0 (143452000)	NEXTERS GLOBAL LTD	6	2	0.0
Jelly Drops - Free Puzzle Games (com.cookapps.playgrounds.ff.jellypopmania), v4.0.4 (200092)	CookApps	6	0	0.0
Spider Solitaire - Offline Free Card Games (com.sngict.spider), v2.1.1 (4028)	SNG Games	6	2	0.0
My Home - Design Dreams (com.spacegame.homedesign), v1.0.219 (91)	Zentertain	6	2	0.0
Cookie Jam™ Match 3 Games Connect 3 or More (air.com.sgn.cookiejam.gp), v10.20.011 (1010020011)	Jam City, Inc.	6	1	0.0
Knighthood (com.king.knightsrage), v1.1.6 (187)	King	6	2	0.0
Matchington Mansion (com.matchington.mansion), v1.68.0 (323)	Firecraft Studios	6	2	0.0
Word Stacks (com.peoplefun.wordstacks), v1.5.1 (440)	PeopleFun	6	0	0.0
8 Ball Pool (com.miniclip.eightballpool), v4.8.5 (2238)	Miniclip.com	5	0	0.0
RAID: Shadow Legends	Plarium Global Ltd	5	2	0.0

(Table Continues)

Table 61 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(com.plarium.raidlegends), v1.15.2 (16264)				
Art of War: Legions (com.addictive.strategy.army), v2.9.2 (292)	10P STUDIO	5	0	0.0
Bricks Breaker Quest (com.mobirix.swipebrick2), v1.0.78 (20051201)	mobirix	5	0	0.0
Make it perfect (com.game.perfection), v1.0.17 (24)	VOODOO	5	0	0.0
Slap Kings (mobi.gameguru.slapkings), v1.2.3 (17)	Lion Studios	5	0	0.0
Gacha Life (air.com.lunime.gachalife), v1.1.4 (1001004)	Lunime	5	2	0.0
Empires & Puzzles: Epic Match 3 (com.smallgiantgames.empires), v29.0.1 (1270)	Small Giant Games	5	0	0.0
SUDOKU - Free Games (com.kraisoft.sudoku), v1.1.512 (181)	Kraisoft	5	0	0.0
Words By Post Free (com.WordsByPostFree), v2.2.1 (34)	Games By Post	5	1	0.0
Casino Slots: Vegas Fever (casino.slots.vegasfever), v1.0.0.3 (27)	AGS Interactive	5	1	0.0
Football Management Ultra 2020 - Manager Game (com.trophymanager.ultra), v2.1.34 (20134)	Trophy Games - Football Manager Game Makers	5	2	0.0
Paper.io 2 (io.voodoo.paper2), v1.5.5 (155)	VOODOO	5	0	0.0
Brain Out - Can you pass it? (com.mind.quiz.brain.out), v1.3.3 (133)	Focus apps	5	0	0.0
CodyCross: Crossword Puzzles (com.fanatee.cody), v1.37.1 (132)	Fanatee, Inc.	5	0	0.0
Candy Crush Saga (com.king.candycrushsaga), v1.176.0.2 (11760021)	King	4	0	0.0
Farm Heroes Saga (com.king.farmheroessaga), v5.37.5 (330041)	King	4	0	0.0
Candy Crush Soda Saga (com.king.candycrushsodasaga), v1.168.2 (11681020)	King	4	0	0.0
Wordscapes (com.peoplefun.wordcross), v1.7.0 (1128)	PeopleFun	4	0	0.0
Archer0 (com.habby.archero), v1.4.7 (429)	Habby	4	0	0.0
Candy Crush Friends Saga (com.king.candycrushfriendsaga), v1.100.0.1 (1100001)	King	4	0	0.0

(Table Continues)

Table 61 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(com.king.candycrush4), v1.37.4 (2037104)				
Merge Dragons!	Gram Games Limited	4	0	0.0
(com.gramgames.mergedragons), v4.10.0 (457)				
Idle Army Base	Neon Play	4	0	0.0
(com.neonplay.casualidlearmybase), v1.10.2 (271)				
Game of Words: Free Word Games & Puzzles	DreamLoft	4	0	0.0
(com.TinyBit.GameOfWords), v1.27.0 (141)				
Cash Hunter Casino -Free Vegas Slot Machine	Seven Slots Tech - Free Jackpot Slots Casino	4	0	0.0
(vegas.slots.cash.hunter.free.bonus.casino), v1.00.06 (10006)				
Sportfusion - Unofficial News for Liverpool	SportFusion	4	0	0.0
(com.sportstream.premier.liverpool), v3.953 (6323)				
Ludo Bing	DotFinger Games	4	0	0.0
(com.dotfinger.ludo.free), v2.1.2 (25)				
Fire Emblem Heroes	Nintendo Co., Ltd.	4	0	0.0
(com.nintendo.zaba), v4.5.0 (529623)				
Antimatter Dimensions	Jakub Kajfosz	3	0	0.0
(kajfosz.antimatterdimensions), v2.23.1 (20230010)				
TOP SEED Tennis: Sports Management Simulation Game	Gaminho	3	0	0.0
(com.gaminho.topseedtennis), v2.42.7 (2042007000)				
Ahri RPG	DOOMSDAY Studio	3	1	0.0
(com.DoomsdayStudio.AhriRPG), v2.1 (39)				
Freecell in Nature	doctor2jk	3	0	0.0
(com.jellybrain.freecell), v3.22 (11)				
Solitaire suite - 25 in 1	Quarzo Apps	3	0	0.0
(com.quarzo.solitairepack), v1.1.5 (115)				
Mahjong	1bsyl	3	1	0.0
(net.game.mahjong), v1.35 (135300)				
Solitaire HD	Till Essers	2	0	0.0
(de.heimlich.gut.solitaire.hd), v1.1.2 (5)				
Block Puzzle 2020	Replay Entertainment	2	0	0.0
(com.re.blockpuzzleclassic), v1.0 (5)				

D.1.3 Third-Party SDKs

We were able to identify 229 SDKs embedded within the 163 Games apps. We list the 40 most common SDKs in Table 62,¹¹⁰ along with the number of Games apps in which they were detected.

Table 62: The 40 most common SDKs identified within apps in the Games category.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	147	(90.2%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	144	(88.3%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	143	(87.7%)
Google Play	Google Play	App Market	117	(71.8%)
Facebook Analytics	Facebook	Mobile Analytics	114	(69.9%)
Facebook Login	Facebook	Digital Identity Advertisement Mobile Analytics	113	(69.3%)
Google Ads	Google	Advertisement	113	(69.3%)
Unity3D	Unity Technologies	Game Engine Mobile Analytics Advertisement	112	(68.7%)
Facebook Share	Facebook	Social Network Advertisement Mobile Analytics	111	(68.1%)
Google DoubleClick	Google	Advertisement	109	(66.9%)
Google Gson	Google	Development Aid	100	(61.3%)
ZXing ("Zebra Crossing")	ZXing Project	Development Aid	91	(55.8%)

(Table Continues)

¹¹⁰For an explanation of SDKs, see Section 4.1.2.

Table 62 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Facebook Ads	Facebook	Advertisement	89	(54.6%)
Crashlytics	Google	Mobile Analytics	81	(49.7%)
Moat	Oracle	Mobile Analytics	81	(49.7%)
Unity3d Ads	Unity Technologies	Advertisement	80	(49.1%)
Fmod	Firelight Technologies	Game Engine	75	(46.0%)
IronSource	IronSource	Advertisement Mobile Analytics	75	(46.0%)
Applovin	AppLovin	Advertisement	70	(42.9%)
Vungle	Vungle	Advertisement	67	(41.1%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	57	(35.0%)
Facebook Places	Facebook	Map/LBS Advertisement	51	(31.3%)
adjust	Adjust	Mobile Analytics Advertisement	49	(30.1%)
picasso	Square Inc.	Development Aid	49	(30.1%)
MoPub	Twitter	Advertisement	48	(29.4%)
AdColony	AdColony	Advertisement	44	(27.0%)
ChartBoost	Chartboost	Advertisement	40	(24.5%)
Inmobi	InMobi	Advertisement	37	(22.7%)
HelpShift	HelpShift	Mobile Analytics	35	(21.5%)
Google Analytics	Google	Mobile Analytics	34	(20.9%)
Fyber	Fyber	Advertisement	32	(19.6%)
Google Tag Manager	Google	Mobile Analytics	31	(19.0%)
Integral Ad Science	Integral Ad Science Inc.	Mobile Analytics Advertisement AdFraud	31	(19.0%)
Amazon Advertisement	Amazon	Advertisement	28	(17.2%)

(Table Continues)

Table 62 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Mintegral	Mobvista	Advertisement	26	(16.0%)
Google Core Libraries for Java 6+	Google	Development Aid	26	(16.0%)
cocos2DX	cocos2dx	Game Engine	26	(16.0%)
Tapjoy	Tapjoy	Advertisement	25	(15.3%)
Glide	Bump Technologies	Development Aid	24	(14.7%)
Apache Common	The Apache Software Foundation	Development Aid	24	(14.7%)

Several of these SDKs included developer tools, which we characterize as SDKs that provide tools and functionality to app developers which are unlikely to be used for the transmission of user information. As a result, we separately present Table 63, which depicts the 40 most common SDKs with developer tools removed, along with the number of Games apps in which they were detected.

Table 63: The 40 most common SDKs identified within apps in the Games category, with developer tools removed.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	147	(90.2%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	144	(88.3%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	143	(87.7%)
Google Play	Google Play	App Market	117	(71.8%)
Facebook Analytics	Facebook	Mobile Analytics	114	(69.9%)

(Table Continues)

Table 63 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Facebook Login	Facebook	Digital Identity Advertisement Mobile Analytics	113	(69.3%)
Google Ads	Google	Advertisement	113	(69.3%)
Unity3D	Unity Technologies	Game Engine Mobile Analytics Advertisement	112	(68.7%)
Facebook Share	Facebook	Social Network Advertisement Mobile Analytics	111	(68.1%)
Google DoubleClick	Google	Advertisement	109	(66.9%)
Facebook Ads	Facebook	Advertisement	89	(54.6%)
Crashlytics	Google	Mobile Analytics	81	(49.7%)
Moat	Oracle	Mobile Analytics	81	(49.7%)
Unity3d Ads	Unity Technologies	Advertisement	80	(49.1%)
IronSource	IronSource	Advertisement Mobile Analytics	75	(46.0%)
Applovin	AppLovin	Advertisement	70	(42.9%)
Vungle	Vungle	Advertisement	67	(41.1%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	57	(35.0%)
Facebook Places	Facebook	Map/LBS Advertisement	51	(31.3%)
adjust	Adjust	Mobile Analytics Advertisement	49	(30.1%)
MoPub	Twitter	Advertisement	48	(29.4%)
AdColony	AdColony	Advertisement	44	(27.0%)
ChartBoost	Chartboost	Advertisement	40	(24.5%)
Inmobi	InMobi	Advertisement	37	(22.7%)
HelpShift	HelpShift	Mobile Analytics	35	(21.5%)

(Table Continues)

Table 63 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Analytics	Google	Mobile Analytics	34	(20.9%)
Fyber	Fyber	Advertisement	32	(19.6%)
Google Tag Manager	Google	Mobile Analytics	31	(19.0%)
Integral Ad Science	Integral Ad Science Inc.	Mobile Analytics Advertisement AdFraud	31	(19.0%)
Amazon Advertisement	Amazon	Advertisement	28	(17.2%)
Mintegral	Mobvista	Advertisement	26	(16.0%)
Tapjoy	Tapjoy	Advertisement	25	(15.3%)
Smaato	Smaato	Advertisement LBS	21	(12.9%)
Bugly	Tencent	Mobile Analytics	17	(10.4%)
HyprMX	HyprMX	Advertisement	17	(10.4%)
Volley HTTP library	Google	Development Aid Networking	16	(9.8%)
Amazon In-App Purchasing	Amazon	Payment	15	(9.2%)
Flurry	Verizon	Mobile Analytics	15	(9.2%)
myTarget	My.com	Advertisement Social Networking	12	(7.4%)
Inneractive	Fyber	Advertisement	12	(7.4%)

D.2 Tools Apps

D.2.1 Data Types Transmitted

Apps in the Tools category were observed transmitting the data types listed in Table 64 during the testing period.¹¹¹

Data Type	# of Apps	(% of Apps)
AAID	57	(59.4%)
Android ID	41	(42.7%)
WiFi MAC	12	(12.5%)
IMEI	5	(5.2%)
BT Name	5	(5.2%)
Serial #	3	(3.1%)
GPS Location	1	(1.0%)
Coarse Location	1	(1.0%)
WiFi SSID	1	(1.0%)
WiFi BSSID	1	(1.0%)
SIM ID	1	(1.0%)
IMSI	1	(1.0%)
BT BSSID	1	(1.0%)

Table 64: Data types transmitted by apps in the Tools category during the testing period.

¹¹¹For an explanation of these data types, see Section 3.

D.2.1.1 Most Common Hostnames Contacted

Table 65 depicts the top 10 hostnames observed being contacted by Tools apps during the testing period, whereas Table 66 depicts the top 10 parent companies corresponding to these hostnames. This data reflects Internet servers that were *contacted* by apps, but does not necessarily mean that they received sensitive user information—we specifically discuss that subset of recipients in Section D.2.1.2.¹¹² The discrepancy between the two sections is due to the fact that some app transmissions may simply not contain sensitive user information or that its transmission was obfuscated using a method that we did not immediately recognize.

Hostname	Parent Company	# of Apps	(% of Apps)
graph.facebook.com	Facebook	42	(43.8%)
googleads.g.doubleclick.net	Google	39	(40.6%)
settings.crashlytics.com	Google	30	(31.2%)
www.facebook.com	Facebook	25	(26.0%)
pagead2.googleadservices.com	Google	23	(24.0%)
lh3.googleusercontent.com	Google	21	(21.9%)
tpc.googlesyndication.com	Google	20	(20.8%)
localhost		18	(18.8%)
ads.mopub.com	Twitter	16	(16.7%)
www.gstatic.com	Google	14	(14.6%)

Table 65: The top 10 most common hostnames contacted by Tools apps during testing.

Company	# of Apps	(% of Apps)
Google	68	(70.8%)
Facebook	46	(47.9%)
Twitter	16	(16.7%)
Liftoff	15	(15.6%)
AppsFlyer	14	(14.6%)
Alibaba	12	(12.5%)
Ogury	5	(5.2%)
Verizon	5	(5.2%)
ANTIY Labs	5	(5.2%)
Unity Technologies	5	(5.2%)

Table 66: The top 10 most common companies contacted by Tools apps during testing.

¹¹²We define “user information” in Section 3.

D.2.1.2 Most Common Data Recipients

Table 67 depicts the top 10 data recipients among the Tools apps during the testing period. Table 68 lists additional information about the most common data recipients, such as the approximate locations of their servers, IP addresses contacted during testing, and the types of sensitive user information that we observed them receive during the testing period.

Hostname	Parent Company	# of Apps	(% of Apps)
graph.facebook.com	Facebook	42	(43.8%)
www.facebook.com	Facebook	13	(13.5%)
www.cnplusplus.com		12	(12.5%)
ads.mopub.com	Twitter	11	(11.5%)
t.appsflyer.com	AppsFlyer	8	(8.3%)
mpx.mopub.com	Twitter	8	(8.3%)
ulogs.umeng.com	Alibaba	8	(8.3%)
impression-east.liftoff.io	Liftoff	6	(6.2%)
plbslog.umeng.com	Alibaba	6	(6.2%)
events.appsflyer.com	AppsFlyer	4	(4.2%)

Table 67: The top 10 most common data recipients from Tools apps during testing.

Table 68: The 10 most common recipient hostnames of user information from Tools apps during the testing period, along with their IP addresses, company information, and the data types that were observed being transmitted.

Parent Company	Country	IPs	Received Data
		graph.facebook.com	
Facebook	United States	157.240.8.18 (US)	Android ID AAID
		www.facebook.com	
Facebook	United States	157.240.8.35 (US)	AAID
		www.cnplusplus.com	
		18.182.64.178 (JP)	Android ID
		ads.mopub.com	
Twitter	United States	192.48.236.11 (US) 192.48.236.12 (US) 192.48.236.9 (US) 192.48.236.10 (US)	AAID
		ulogs.umeng.com	
Alibaba	China	203.119.207.251 (CN) 203.119.214.125 (CN) 203.119.207.250 (CN)	BT Name Android ID AAID WiFi MAC
		t.appsflyer.com	
AppsFlyer	United States	18.202.209.28 (IE) 18.203.28.132 (IE) 54.76.160.155 (IE) 34.255.152.81 (IE) 54.154.47.113 (IE) 34.252.149.99 (IE) 52.19.47.237 (IE) 108.128.82.85 (IE)	Android ID AAID
		mpx.mopub.com	
		(Table Continues)	

Table 68 (Continued)

Parent Company	Country	IPs	Received Data
Twitter	United States	192.48.236.11 (US) 192.48.236.12 (US) 192.48.236.9 (US) 192.48.236.10 (US)	AAID
plbslog.umeng.com			
Alibaba	China	203.119.207.251 (CN) 203.119.214.125 (CN) 203.119.207.250 (CN)	Android ID AAID WiFi MAC
impression-east.liftoff.io			
Liftoff	United States	18.233.123.55 (US)	AAID
alog.umeng.com			
Alibaba	China	106.11.84.6 (CN) 106.11.86.69 (CN) 203.119.218.58 (CN)	Android ID WiFi MAC AAID Serial # IMEI

D.2.1.3 Apps Ranked by Number of Recipients

Table 69 ranks the Tools apps based on the number of recipients to which we detected each transmit sensitive user information during testing.

Table 69: Tools apps ordered by the number of recipients (by unique hostnames and their parent companies) during the testing period.

App	Developer	Installs	Recipients	
			Hostnames	Companies
Virus Cleaner-Antivirus, Phone Clean, Boost Master Package Name: virus.cleaner.antivirus.phone.security.boost Version: 1.3.3 (133)	Super Security Studio	1,000,000	19	13
APUS Security - Clean Virus, Antivirus, Booster Package Name: com.guardian.security.pri Version: 1.2.2 (206)	APUS Group	10,000,000	12	8
Powerful Cleaner (Boost&Clean) Package Name: com.powerful.cleaner Version: 3.0.22 (234)	Powerful cleaner dev	10,000,000	10	7
One Security - Antivirus, Cleaner, Booster Package Name: com.cleanteam.onesecurity Version: 1.0.9.0 (1090)	One Family	5,000,000	9	7
Virus Cleaner - Antivirus, Booster & Phone Clean Package Name: antivirus.anti.virus.cleaner.security.booster Version: 1.3.5 (135)	Phone Clean Apps	5,000,000	11	7
Geek Cleaner - Easy & Smart Cleaner Package Name: com.geek.cleaner.francis.cony Version: 1.1.05 (1105)	Francis Team	100,000	10	6
Translate All - Speech Text Camera Translator Package Name: com.speech.text.translate Version: 1.6.1 (62)	Translator Lab	10,000,000	8	5
One Booster - Antivirus, Booster, Phone Cleaner Package Name: com.cleanteam.oneboost Version: 1.4.2.1 (1421)	One Family	10,000,000	7	5
Fine Booster - Powerful Android Optimize Tool Package Name: com.fine.booster.carytool Version: 1.3.03 (1303)	For World Peace	500,000	8	5
Aloha Browser - private fast browser with free VPN Package Name: com.alohamobile.browser Version: 2.16.4 (121445)	Aloha Mobile	10,000,000	5	4
Simeji Japanese keyboard+Emoji Package Name: com.adamrocker.android.input.simeji Version: 14.5.2 (744)	バイドゥ株式会社	10,000,000	4	4

(Table Continues)

Table 69 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Pedometer Package Name: com.baidu.news.pedometer Version: 1.1.1 (111)	Bright Star Lab	100,000	7	4
Safe Security - Antivirus, Booster, Phone Cleaner Package Name: com.qihoo.security Version: 5.6.8.4831 (2599)	Safe Security Develop	100,000,000	7	3
Call Recorder - Automatic Call Recorder Package Name: call.recorder.automatic.acr Version: 2.0.6 (206)	Call Free, Caller ID, Call Recorder by Call Team	10,000,000	6	3
Notepad - Write Notes, Checklists & Reminders Package Name: com.ztnstudio.notepad Version: 2.0.688 (16601)	Sappalodapps Development	10,000,000	4	3
My Telstra Package Name: com.telstra.mobile.android.mytelstra Version: 51.0.87 (101)	Telstra Corporation Ltd.	5,000,000	7	3
Super Security –Antivirus, AppLock, Virus Cleaner Package Name: com.ludashi.security Version: 2.1.7 (11)	DUALSPACE studio	1,000,000	6	3
DO Multiple Accounts - Infinite Parallel Clone App Package Name: do.multiple.cloner Version: 2.32.01.0426 (23201)	River Stone Tech	1,000,000	4	3
Bass Booster & Equalizer - Virtualizer Package Name: com.bass.boost.equalizer.music.pro Version: 1.0.6 (10006)	Emily Team	100,000	5	3
Pulse Cleaner - Phone Booster & Optimizer Package Name: mobi.pulse.space.boost.cleaner Version: 1.0.39.200316 (39)	pulse app studio	50,000	5	3
AVG AntiVirus 2020 for Android Security Free Package Name: com.antivirus Version: 6.27.3 (323799)	AVG Mobile	100,000,000	6	2
Avast Antivirus –Scan & Remove Virus, Cleaner Package Name: com.avast.android.mobilesecurity Version: 6.27.3 (323799)	Avast Software	100,000,000	6	2
Emoji keyboard - Cute Emoticons, GIF, Stickers Package Name: com.emoji.coolkeyboard Version: 3.4.2034 (203401)	Emoji Keyboard & Sticker Design Team	100,000,000	2	2
VPNhub Best Free Unlimited VPN - Secure WiFi Proxy Package Name: com.appatomic.vpnhub Version: 2.11.11-mobile (211111)	AppAtomic Limited	10,000,000	3	2
Laban Key Go Tieng Viet Package Name: com.vng.inputmethod.labankey	Zalo Group	10,000,000	3	2

(Table Continues)

Table 69 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Version: 20.4.2 (20040261) Space Clean & Super Phone Cleaner Package Name: com.ludashi.superclean Version: 4.0.7 (47)	DUALSPACE studio	10,000,000	3	2
Super S9 Launcher for Galaxy S9/S8/S10 launcher Package Name: com.s9launcher.galaxy.launcher Version: 5.2 (47)	Super Launcher Serie	10,000,000	3	2
KeepClean - Cleaner & Faster Package Name: com.appsinnova.android.keepclean Version: 2.1.2 (10002102)	APPS INNOVA	10,000,000	5	2
My Vodafone Package Name: au.com.vodafone.mobile.gss Version: 4.0.29 (339033)	Vodafone Hutchison Australia Pty Ltd	1,000,000	2	2
Cleaner For Android :Phone Booster & RAM Optimizer Package Name: com.systweak.systemoptimizer Version: 7.9.9.31 (50)	SYSTWEAK SOFTWARE PRIVATE LIMITED	1,000,000	2	2
Editin Photos Package Name: com.ailli.mycameras.imageedit Version: 1.1.0 (110)	Vanila iTech	1,000,000	2	2
Mobile Security & Antivirus Package Name: com.trendmicro.tmmpersonal Version: 11.3.0 (11302612)	Trend Micro	1,000,000	6	2
Memory cleaner. Speed booster & junk removal Package Name: com.junkremoval.pro Version: 1.0.14 (24)	essential tools	1,000,000	4	2
Super Wallpapers Flashlight & Compass Package Name: com.wallpaper.flashlight.compass Version: 1.1.3 (113)	Rio Reader LLC	500,000	2	2
Padenatof Package Name: com.sun.newjbq.beijing.ten Version: 1.0.2 (102)	Holmes Shop	500,000	2	2
Ssafe Security - junk virus cleaner Package Name: com.antivirus.s.security.booster.speedup Version: 1.3.8 (12)	Paas Dev	500,000	2	2
P Launcher 2020 new Package Name: com.or.launcher.oreo Version: 6.3 (59)	N Dev Team	500,000	3	2
R.L. Wallpapers Flashlight&Compass Package Name: com.fla.wal.compas Version: 1.1.0 (110)	Dany iApp	100,000	2	2
Splendid Live Wallpapers	Thomass Lab (Table Continues)	100,000	2	2

Table 69 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Package Name: com.my.new.wallpaper.lww Version: 1.1.1 (111)				
Powerful Flashlight Package Name: com.meituan.ybw.flash Version: 1.0.9 (109)	SR Media Market	100,000	2	2
Clean Fast Pro –a smart & fast way to clean phone Package Name: com.clean.booster.junk.faster.cooler Version: 1.0.5 (5)	Deepcleaner Tech	100,000	2	2
iPlayer & iWallpaper Package Name: com.lal.videoedit.iwallpapers Version: 1.1.3 (113)	Hopesalive	100,000	2	2
Superb Wallpapers Flashlight Compass all in one Package Name: com.tencent.tl.wallpaper Version: 1.0.4 (104)	Rocky Station	100,000	2	2
Fashion Wallpapers Package Name: com.fasyang.wallpaperproject Version: 1.0.8 (108)	Venice High	100,000	2	2
Color Wallpapers Package Name: com.play.ljj.wallpapercomapss Version: 1.0.8 (108)	Creative Park Zone	100,000	2	2
Super Flashlight Package Name: com.superapp.xincheng Version: 1.0.8 (108)	Craig's Hub	100,000	2	2
Sirius Cleaner - Phone Booster, CPU Cooler ,Cache Package Name: com.purifylbx.siriuscleaner Version: 1.2.0 (20)	purify	100,000	3	2
Language Translator: Voice Translator, Interpreter Package Name: com.beldum.translator Version: 1.1.3 (13)	Beldum Studio	100,000	5	2
AppLock - Fingerprint Package Name: com.sp.protector.free Version: 7.5.2 (194)	SpSoft	50,000,000	1	1
Phone Cleaner- Cache Clean, Android Booster Master Package Name: phone.cleaner.speed.booster.cache.clean.android.master Version: 1.3.7 (46)	Super Cleaner Studio	50,000,000	1	1
搜狗输入法 Package Name: com.sohu.inputmethod.sogou Version: 8.31.6 (956)	Sogou.com Inc.	10,000,000	1	1
Virus Cleaner - Antivirus Free & Phone Cleaner Package Name: phone.antivirus.virus.cleaner.junk.clean.speed.booster.master Version: 1.1.10 (23)	Super Cleaner Studio	10,000,000	1	1

(Table Continues)

Table 69 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
NordVPN –fast VPN app for privacy & security Package Name: com.nordvpn.android Version: 4.12.5 (662)	NordVPN apps	10,000,000	1	1
Message Text and Call Video Chat Free Package Name: com.messengerfree.forchat Version: 1.15 (16)	X-Game	5,000,000	1	1
My Optus Package Name: au.com.optus.selfservice Version: 5.12 (454)	Optus Mobile Pty Ltd	1,000,000	1	1
Phone Guardian Mobile Security & VPN Protection Package Name: com.distimo.phoneguardian Version: 2.8.1 (2020050113)	App Annie Basics	1,000,000	3	1
Private Downloader Package Name: com.mirmay,privatedownloader Version: 3.0.166 (166)	Mirmay Limited	1,000,000	1	1
Recovery all photo deleted Package Name: com.vttl.app7.restoreimages Version: 1.9 (10)	V TTL	1,000,000	1	1
Multi Parallel - Multiple Accounts & App Clone Package Name: multi.parallel.dualspace.cloner Version: 1.3.60.0427 (1360)	Winterfell Applab - Clone App & Status Downloader	1,000,000	2	1
Call Recorder (No Ads) Package Name: com.boldbeast.recorder Version: 13.2 (90)	Boldbeast Software Inc.	1,000,000	1	1
Nielsen Mobile App Package Name: com.nielsen.odm Version: 8.1.5 (6972)	Nielsen Company	500,000	1	1
SnapGrab - Private Screenshot Tool with Encryption Package Name: com.wathenwebworks.snapgrab Version: 3.2.3 (323)	Wathen Web Works	100,000	1	1
Google Package Name: com.google.android.googlequicksearchbox Version: 11.8.9.21.arm64 (301084796)	Google LLC	5,000,000,000	0	0
Gboard - the Google Keyboard Package Name: com.google.android.inputmethod.latin Version: 9.3.12.308268050-release-arm64-v8a (26931226)	Google LLC	1,000,000,000	0	0
Clock Package Name: com.google.android.deskclock Version: 6.2.1 (280557501) (62101012)	Google LLC	500,000,000	0	0
Calculator Package Name: com.google.android.calculator	Google LLC	500,000,000	0	0

(Table Continues)

Table 69 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Version: 7.8 (271241277) (78000303) Google Translate Package Name: com.google.android.apps.translate Version: 6.8.0.RC07.310451137 (68000765)	Google LLC	500,000,000	0	0
Phone Package Name: com.google.android.dialer Version: 48.0.308707326 (5602463)	Google LLC	100,000,000	0	0
Google Go: A lighter, faster way to search Package Name: com.google.android.apps.searchlite Version: 3.6.308027732.release (233152)	Google LLC	100,000,000	0	0
Files by Google: Clean up space on your phone Package Name: com.google.android.apps.nbu.files Version: 1.0.302918309 (35547)	Google LLC	100,000,000	0	0
Samsung Smart Switch Mobile Package Name: com.sec.android.easyMover Version: 3.7.05.8 (370508100)	Samsung Electronics Co., Ltd.	100,000,000	0	0
Google Authenticator Package Name: com.google.android.apps.authenticator2 Version: 5.10 (5000100)	Google LLC	50,000,000	0	0
DuckDuckGo Privacy Browser Package Name: com.duckduckgo.mobile.android Version: 5.53.1 (55301)	DuckDuckGo	10,000,000	0	0
Digital Clock Widget Package Name: com.maize.digitalClock Version: 3.0.3 (88)	Maize	10,000,000	0	0
Assistive Touch iOS 13 Package Name: com.luutinhit.assistivetouch Version: 2.3.6 (236)	LuuTinh Developer	10,000,000	0	0
Lock screen password Package Name: com.green.banana.app.lockscreenpassword Version: 3.35.3384.118 (35)	Green Banana Studio	10,000,000	0	0
Control Center iOS 13 Package Name: com.luutinhit.controlcenter Version: 2.9.6 (296)	LuuTinh Developer	10,000,000	0	0
Boost+ Speed, Clean, Security Package Name: com.htc.pitroad Version: 1.90.1106613 (169081233)	HTC Corporation	5,000,000	0	0
Farsi Keyboard Package Name: com.bolorian.android.farsikeyboard Version: 5.4 (64)	Khosrov Bolorian	1,000,000	0	0
Norton App Lock	Norton Labs (Table Continues)	1,000,000	0	0

Table 69 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Package Name: com.symantec.aplock Version: 1.4.0.503 (503)				
Screen Time - Restrain yourself & parent control Package Name: master.app.screentime Version: 2.2.1 (120201)	IRIDIUM DUST LIMITED	1,000,000	0	0
Network Monitor Mini Package Name: info.kfsoft.android.TrafficIndicator Version: 1.0.259 (259)	KF Software House	1,000,000	0	0
Pie Control Package Name: jun.ace.piecontrol Version: 7.1.2 Sextans (72)	coolAce	1,000,000	0	0
Ultimate Rotation Control Package Name: nl.fameit.rotate Version: 6.3.5 (Google) (6035)	FaMe IT	1,000,000	0	0
SwiftRepost Package Name: insta.vidmateapp Version: 15.0 (30000115)	WS INFOTECH	1,000,000	0	0
Elixir 2 - Widgets Package Name: com.bartat.android.elixir.widget Version: 2.43.3 (104)	Tamás Barta	500,000	0	0
Fast Cache Cleaner Package Name: jp.snowlife01.android.cache_delete Version: 2.2.0 (15)	HDM Dev Team	500,000	0	0
Boost Master Package Name: com.rwasoft.booster Version: 3.6.0 (210)	Rwasoft	500,000	0	0
Service NSW Package Name: au.gov.nsw.service Version: 4.17.0 (88441) (118441)	Service NSW	500,000	0	0
Fullscreen Immersive - No Ads, No Root Package Name: immersive.duna.com.immersivemode Version: 3.4 (72)	PhotoSafe Inc.	100,000	0	0
무음카메라로 Package Name: com.simpler.more.silencecamera Version: 1.2.03 (15)	More Simpler	100,000	0	0
Phone Profiles Plus Package Name: sk.henrichg.phoneprofilesplus Version: 4.1.8.4 (5990)	Henrich Gron	50,000	0	0
OzBargain Free Package Name: com.minasolution.tools.ozbargainfree Version: 1.6.18 (39)	Minasolution	50,000	0	0

(Table Continues)

Table 69 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Spoilers Blocker Package Name: com.invariantlabs.spoilers Version: 1.0.6 (7)	Invariant Labs	10,000	0	0
Memory Optimizer Package Name: com.vapp.memory_optimizer Version: 2.4 (19)	V D Apps	10,000	0	0
Pixel Launcher Package Name: com.google.android.apps.nexuslauncher Version: 7.1.1-3862848 (151)	Google LLC	1	0	0

D.2.1.4 Popular Apps Transmitting Each Data Type

For each of these data types, Table 70 lists the top 5 most popular Tools apps that we observed transmitting them during testing.¹¹³

Table 70: The top 5 Tools apps that we detected transmitting each data type during the testing period.

Data Type	Top 5 Apps	Developer	# of Installs
AAID	AVG AntiVirus 2020 for Android Security Free (com.antivirus), v6.27.3 (323799)	AVG Mobile	100,000,000
	Avast Antivirus –Scan & Remove Virus, Cleaner (com.avast.android.mobilesecurity), v6.27.3 (323799)	Avast Software	100,000,000
	Safe Security - Antivirus, Booster, Phone Cleaner (com.qihoo.security), v5.6.8.4831 (2599)	Safe Security Develop	100,000,000
	Emoji keyboard - Cute Emoticons, GIF, Stickers (com.emoji.coolkeyboard), v3.4.2034 (203401)	Emoji Keyboard & Sticker Design Team	100,000,000
	Phone Cleaner- Cache Clean, Android Booster Master (phone.cleaner.speed.booster.cache.clean.android.master), v1.3.7 (46)	Super Cleaner Studio	50,000,000
Android ID	AVG AntiVirus 2020 for Android Security Free (com.antivirus), v6.27.3 (323799)	AVG Mobile	100,000,000
	Avast Antivirus –Scan & Remove Virus, Cleaner (com.avast.android.mobilesecurity), v6.27.3 (323799)	Avast Software	100,000,000
	Emoji keyboard - Cute Emoticons, GIF, Stickers (com.emoji.coolkeyboard), v3.4.2034 (203401)	Emoji Keyboard & Sticker Design Team	100,000,000
	AppLock - Fingerprint (com.sp.protector.free), v7.5.2 (194)	SpSoft	50,000,000
	Aloha Browser - private fast browser with free VPN (com.alohamobile.browser), v2.16.4 (121445)	Aloha Mobile	10,000,000
	One Booster - Antivirus, Booster, Phone Cleaner (com.cleanteam.oneboost), v1.4.2.1 (1421)	One Family	10,000,000
Super S9 Launcher for Galaxy S9/S8/S10 launcher (com.s9launcher.galaxy.launcher), v5.2 (47)	Super Launcher Serie	10,000,000	
One Security - Antivirus, Cleaner, Booster (com.cleanteam.onesecurity), v1.0.9.0 (1090)	One Family	5,000,000	
Virus Cleaner - Antivirus, Booster & Phone Clean (antivirus.anti.virus.cleaner.security.booster), v1.3.5 (135)	Phone Clean Apps	5,000,000	
Multi Parallel - Multiple Accounts & App Clone (Table Continues)	Winterfell Applab - Clone App & Status Downloader	1,000,000	

¹¹³Popularity is determined by the number of reported installs in the Google Play Store.

Table 70 (Continued)

Data Type	Top 5 Apps	Developer	# of Installs
	(multi.parallel.dualspace.cloner), v1.3.60.0427 (1360)		
IMEI	Notepad - Write Notes, Checklists & Reminders (com.ztnstudio.notepad), v2.0.688 (16601)	Sappalodapps Development	10,000,000
	搜狗输入法 (com.sohu.inputmethod.sogou), v8.31.6 (956)	Sogou.com Inc.	10,000,000
	One Security - Antivirus, Cleaner, Booster (com.cleanteam.onesecurity), v1.0.9.0 (1090)	One Family	5,000,000
	Virus Cleaner-Antivirus, Phone Clean, Boost Master (virus.cleaner.antivirus.phone.security.boost), v1.3.3 (133)	Super Security Studio	1,000,000
	Call Recorder (No Ads) (com.boldbeast.recorder), v13.2 (90)	Boldbeast Software Inc.	1,000,000
BT Name	Multi Parallel - Multiple Accounts & App Clone (multi.parallel.dualspace.cloner), v1.3.60.0427 (1360)	Winterfell Applab - Clone App & Status Downloader	1,000,000
	Super Security -Antivirus, AppLock, Virus Cleaner (com.ludashi.security), v2.1.7 (11)	DUALSPACE studio	1,000,000
	DO Multiple Accounts - Infinite Parallel Clone App (do.multiple.cloner), v2.32.01.0426 (23201)	River Stone Tech	1,000,000
	Fine Booster - Powerful Android Optimize Tool (com.fine.booster.carytool), v1.3.03 (1303)	For World Peace	500,000
	Geek Cleaner - Easy & Smart Cleaner (com.geek.cleaner.francis.cony), v1.1.05 (1105)	Francis Team	100,000
Serial #	Notepad - Write Notes, Checklists & Reminders (com.ztnstudio.notepad), v2.0.688 (16601)	Sappalodapps Development	10,000,000
	One Security - Antivirus, Cleaner, Booster (com.cleanteam.onesecurity), v1.0.9.0 (1090)	One Family	5,000,000
	Virus Cleaner-Antivirus, Phone Clean, Boost Master (virus.cleaner.antivirus.phone.security.boost), v1.3.3 (133)	Super Security Studio	1,000,000
GPS Location	Notepad - Write Notes, Checklists & Reminders (com.ztnstudio.notepad), v2.0.688 (16601)	Sappalodapps Development	10,000,000
Coarse Location	Notepad - Write Notes, Checklists & Reminders (com.ztnstudio.notepad), v2.0.688 (16601)	Sappalodapps Development	10,000,000
WiFi SSID	Notepad - Write Notes, Checklists & Reminders (Table Continues)	Sappalodapps Development	10,000,000

Table 70 (Continued)

Data Type	Top 5 Apps	Developer	# of Installs
	(com.ztnstudio.notepad), v2.0.688 (16601)		
WiFi BSSID	Notepad - Write Notes, Checklists & Reminders (com.ztnstudio.notepad), v2.0.688 (16601)	Sappalodapps Development	10,000,000
SIM ID	搜狗输入法 (com.sohu.inputmethod.sogou), v8.31.6 (956)	Sogou.com Inc.	10,000,000
IMSI	搜狗输入法 (com.sohu.inputmethod.sogou), v8.31.6 (956)	Sogou.com Inc.	10,000,000
BT BSSID	Pedometer (com.baidu.news.pedometer), v1.1.1 (111)	Bright Star Lab	100,000

Table 71 lists the 5 most popular Tools apps that transmitted the most data types during the testing period, whereas Table 72 lists the 5 most popular Tools apps that transmitted the fewest data types during the testing period.

Top 5 Apps	Developer	# of Installs	Data Types
Notepad - Write Notes, Checklists & Reminders (com.ztnstudio.notepad), v2.0.688 (16601)	Sappalodapps Development	10,000,000	7
One Security - Antivirus, Cleaner, Booster (com.cleanteam.onesecurity), v1.0.9.0 (1090)	One Family	5,000,000	5
Virus Cleaner-Antivirus, Phone Clean, Boost Master (virus.cleaner.antivirus.phone.security.boost), v1.3.3 (133)	Super Security Studio	1,000,000	5
搜狗输入法 (com.sohu.inputmethod.sogou), v8.31.6 (956)	Sogou.com Inc.	10,000,000	4
Multi Parallel - Multiple Accounts & App Clone (multi.parallel.dualspace.cloner), v1.3.60.0427 (1360)	Winterfell Applab - Clone App & Status Downloader	1,000,000	4

Table 71: The top 5 Tools apps that transmitted the most data types during testing.

Top 5 Apps	Developer	# of Installs	Data Types
Google (com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)	Google LLC	5,000,000,000	0
Gboard - the Google Keyboard (com.google.android.inputmethod.latin), v9.3.12.308268050-release-arm64-v8a (26931226)	Google LLC	1,000,000,000	0
Clock (com.google.android.deskclock), v6.2.1 (280557501) (62101012)	Google LLC	500,000,000	0
Calculator (com.google.android.calculator), v7.8 (271241277) (78000303)	Google LLC	500,000,000	0
Google Translate (com.google.android.apps.translate), v6.8.0.RC07.310451137 (68000765)	Google LLC	500,000,000	0

Table 72: The top 5 Tools apps that transmitted the fewest data types during testing.

D.2.2 App Permissions

Apps in the Tools category requested the dangerous permissions listed in Table 73.¹¹⁴

Data Type	# of Apps	(% of Apps)
WRITE_EXTERNAL_STORAGE	75	(78.1%)
READ_EXTERNAL_STORAGE	66	(68.8%)
READ_PHONE_STATE	53	(55.2%)
CAMERA	43	(44.8%)
ACCESS_FINE_LOCATION	43	(44.8%)
ACCESS_COARSE_LOCATION	36	(37.5%)
GET_ACCOUNTS	33	(34.4%)
RECORD_AUDIO	19	(19.8%)
READ_CONTACTS	18	(18.8%)
CALL_PHONE	13	(13.5%)
WRITE_CONTACTS	11	(11.5%)
WRITE_CALENDAR	7	(7.3%)
READ_CALENDAR	7	(7.3%)
READ_CALL_LOG	3	(3.1%)
SEND_SMS	2	(2.1%)
READ_SMS	2	(2.1%)
WRITE_CALL_LOG	2	(2.1%)
ACCESS_BACKGROUND_LOCATION	2	(2.1%)
USE_SIP	2	(2.1%)
BODY_SENSORS	2	(2.1%)
RECEIVE_SMS	1	(1.0%)
ANSWER_PHONE_CALLS	1	(1.0%)

Table 73: Dangerous permissions requested by apps in the Tools category.

¹¹⁴For an explanation of dangerous permissions, see Section 4.3.

D.2.2.1 Popular Apps Requesting Dangerous Permissions For each of these permissions, Table 74 lists the top 5 most popular apps that we observed requesting dangerous permissions during testing.¹¹⁵

Table 74: The 5 most popular Tools apps that requested each dangerous permission.

Permission	Top 5 Apps	Developer	# of Installs	
WRITE_EXTERNAL_STORAGE	Google (com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)	Google LLC	5,000,000,000	
	Google Translate (com.google.android.apps.translate), v6.8.0.RC07.310451137 (68000765)	Google LLC	500,000,000	
	Phone (com.google.android.dialer), v48.0.308707326 (5602463)	Google LLC	100,000,000	
	AVG AntiVirus 2020 for Android Security Free (com.antivirus), v6.27.3 (323799)	AVG Mobile	100,000,000	
	Avast Antivirus –Scan & Remove Virus, Cleaner (com.avast.android.mobilesecurity), v6.27.3 (323799)	Avast Software	100,000,000	
	READ_EXTERNAL_STORAGE	Google (com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)	Google LLC	5,000,000,000
READ_EXTERNAL_STORAGE	Clock (com.google.android.deskclock), v6.2.1 (280557501) (62101012)	Google LLC	500,000,000	
	AVG AntiVirus 2020 for Android Security Free (com.antivirus), v6.27.3 (323799)	AVG Mobile	100,000,000	
	Avast Antivirus –Scan & Remove Virus, Cleaner (com.avast.android.mobilesecurity), v6.27.3 (323799)	Avast Software	100,000,000	
	Google Go: A lighter, faster way to search (com.google.android.apps.searchlite), v3.6.308027732.release (233152)	Google LLC	100,000,000	
	READ_PHONE_STATE	Google (com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)	Google LLC	5,000,000,000
	READ_PHONE_STATE	Phone (com.google.android.dialer), v48.0.308707326 (5602463)	Google LLC	100,000,000
AVG AntiVirus 2020 for Android Security Free (com.antivirus), v6.27.3 (323799)		AVG Mobile	100,000,000	
Avast Antivirus –Scan & Remove Virus, Cleaner (com.avast.android.mobilesecurity), v6.27.3 (323799)		Avast Software	100,000,000	
(Table Continues)				

¹¹⁵Popularity is determined by the number of reported installs in the Google Play Store.

Table 74 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(com.avast.android.mobilesecurity), v6.27.3 (323799) Files by Google: Clean up space on your phone (com.google.android.apps.nbu.files), v1.0.302918309 (35547)	Google LLC	100,000,000
CAMERA	Google (com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)	Google LLC	5,000,000,000
	Google Translate (com.google.android.apps.translate), v6.8.0.RC07.310451137 (68000765)	Google LLC	500,000,000
	Phone (com.google.android.dialer), v48.0.308707326 (5602463)	Google LLC	100,000,000
	AVG AntiVirus 2020 for Android Security Free (com.antivirus), v6.27.3 (323799)	AVG Mobile	100,000,000
	Avast Antivirus –Scan & Remove Virus, Cleaner (com.avast.android.mobilesecurity), v6.27.3 (323799)	Avast Software	100,000,000
ACCESS_FINE_LOCATION	Google (com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)	Google LLC	5,000,000,000
	Phone (com.google.android.dialer), v48.0.308707326 (5602463)	Google LLC	100,000,000
	AVG AntiVirus 2020 for Android Security Free (com.antivirus), v6.27.3 (323799)	AVG Mobile	100,000,000
	Avast Antivirus –Scan & Remove Virus, Cleaner (com.avast.android.mobilesecurity), v6.27.3 (323799)	Avast Software	100,000,000
	Google Go: A lighter, faster way to search (com.google.android.apps.searchlite), v3.6.308027732.release (233152)	Google LLC	100,000,000
ACCESS_COARSE_LOCATION	Google (com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)	Google LLC	5,000,000,000
	Phone (com.google.android.dialer), v48.0.308707326 (5602463)	Google LLC	100,000,000
	AVG AntiVirus 2020 for Android Security Free (com.antivirus), v6.27.3 (323799)	AVG Mobile	100,000,000
	Avast Antivirus –Scan & Remove Virus, Cleaner (com.avast.android.mobilesecurity), v6.27.3 (323799)	Avast Software	100,000,000
	Files by Google: Clean up space on your phone (com.google.android.apps.nbu.files), v1.0.302918309 (35547)	Google LLC	100,000,000

(Table Continues)

Table 74 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
GET_ACCOUNTS	Google (com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)	Google LLC	5,000,000,000
	Gboard - the Google Keyboard (com.google.android.inputmethod.latin), v9.3.12.308268050- release-arm64-v8a (26931226)	Google LLC	1,000,000,000
	Google Translate (com.google.android.apps.translate), v6.8.0.RC07.310451137 (68000765)	Google LLC	500,000,000
	Phone (com.google.android.dialer), v48.0.308707326 (5602463)	Google LLC	100,000,000
	AVG AntiVirus 2020 for Android Security Free (com.antivirus), v6.27.3 (323799)	AVG Mobile	100,000,000
	RECORD_AUDIO	Google (com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)	Google LLC
	Google Translate (com.google.android.apps.translate), v6.8.0.RC07.310451137 (68000765)	Google LLC	500,000,000
	Phone (com.google.android.dialer), v48.0.308707326 (5602463)	Google LLC	100,000,000
	Avast Antivirus -Scan & Remove Virus, Cleaner (com.avast.android.mobilesecurity), v6.27.3 (323799)	Avast Software	100,000,000
	Google Go: A lighter, faster way to search (com.google.android.apps.searchlite), v3.6.308027732.release (233152)	Google LLC	100,000,000
READ_CONTACTS	Google (com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)	Google LLC	5,000,000,000
	Gboard - the Google Keyboard (com.google.android.inputmethod.latin), v9.3.12.308268050- release-arm64-v8a (26931226)	Google LLC	1,000,000,000
	Phone (com.google.android.dialer), v48.0.308707326 (5602463)	Google LLC	100,000,000
	AVG AntiVirus 2020 for Android Security Free (com.antivirus), v6.27.3 (323799)	AVG Mobile	100,000,000
	Avast Antivirus -Scan & Remove Virus, Cleaner (com.avast.android.mobilesecurity), v6.27.3 (323799)	Avast Software	100,000,000
	CALL_PHONE	Google (Table Continues)	Google LLC

Table 74 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)		
Phone	(com.google.android.dialer), v48.0.308707326 (5602463)	Google LLC	100,000,000
AVG AntiVirus 2020 for Android Security Free	(com.antivirus), v6.27.3 (323799)	AVG Mobile	100,000,000
Avast Antivirus –Scan & Remove Virus, Cleaner	(com.avast.android.mobilesecurity), v6.27.3 (323799)	Avast Software	100,000,000
Google Go: A lighter, faster way to search	(com.google.android.apps.searchlite), v3.6.308027732.release (233152)	Google LLC	100,000,000
WRITE_CONTACTS			
Google	(com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)	Google LLC	5,000,000,000
Phone	(com.google.android.dialer), v48.0.308707326 (5602463)	Google LLC	100,000,000
AVG AntiVirus 2020 for Android Security Free	(com.antivirus), v6.27.3 (323799)	AVG Mobile	100,000,000
Avast Antivirus –Scan & Remove Virus, Cleaner	(com.avast.android.mobilesecurity), v6.27.3 (323799)	Avast Software	100,000,000
Safe Security - Antivirus, Booster, Phone Cleaner	(com.qihoo.security), v5.6.8.4831 (2599)	Safe Security Develop	100,000,000
WRITE_CALENDAR			
Google	(com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)	Google LLC	5,000,000,000
AVG AntiVirus 2020 for Android Security Free	(com.antivirus), v6.27.3 (323799)	AVG Mobile	100,000,000
Avast Antivirus –Scan & Remove Virus, Cleaner	(com.avast.android.mobilesecurity), v6.27.3 (323799)	Avast Software	100,000,000
Samsung Smart Switch Mobile	(com.sec.android.easyMover), v3.7.05.8 (370508100)	Samsung Electronics Co., Ltd.	100,000,000
My Telstra	(com.telstra.mobile.android.mytelstra), v51.0.87 (101)	Telstra Corporation Ltd.	5,000,000
READ_CALENDAR			
Google	(com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)	Google LLC	5,000,000,000
Google Go: A lighter, faster way to search	(com.google.android.apps.searchlite), v3.6.308027732.release (233152)	Google LLC	100,000,000

(Table Continues)

Table 74 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	Samsung Smart Switch Mobile (com.sec.android.easyMover), v3.7.05.8 (370508100)	Samsung Electronics Co., Ltd.	100,000,000
	My Telstra (com.telstra.mobile.android.mytelstra), v51.0.87 (101)	Telstra Corporation Ltd.	5,000,000
	Multi Parallel - Multiple Accounts & App Clone (multi.parallel.dualspace.cloner), v1.3.60.0427 (1360)	Winterfell Applab - Clone App & Status Downloader	1,000,000
READ_CALL_LOG			
	Phone (com.google.android.dialer), v48.0.308707326 (5602463)	Google LLC	100,000,000
	Samsung Smart Switch Mobile (com.sec.android.easyMover), v3.7.05.8 (370508100)	Samsung Electronics Co., Ltd.	100,000,000
	My Vodafone (au.com.vodafone.mobile.gss), v4.0.29 (339033)	Vodafone Hutchison Australia Pty Ltd	1,000,000
SEND_SMS			
	Google (com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)	Google LLC	5,000,000,000
	Phone (com.google.android.dialer), v48.0.308707326 (5602463)	Google LLC	100,000,000
READ_SMS			
	Google (com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)	Google LLC	5,000,000,000
	Samsung Smart Switch Mobile (com.sec.android.easyMover), v3.7.05.8 (370508100)	Samsung Electronics Co., Ltd.	100,000,000
WRITE_CALL_LOG			
	Phone (com.google.android.dialer), v48.0.308707326 (5602463)	Google LLC	100,000,000
	Samsung Smart Switch Mobile (com.sec.android.easyMover), v3.7.05.8 (370508100)	Samsung Electronics Co., Ltd.	100,000,000
ACCESS_BACKGROUND_LOCATION			
	Phone (com.google.android.dialer), v48.0.308707326 (5602463)	Google LLC	100,000,000
	My Vodafone (au.com.vodafone.mobile.gss), v4.0.29 (339033)	Vodafone Hutchison Australia Pty Ltd	1,000,000
USE_SIP			
	Multi Parallel - Multiple Accounts & App Clone (multi.parallel.dualspace.cloner), v1.3.60.0427 (1360)	Winterfell Applab - Clone App & Status Downloader	1,000,000
	DO Multiple Accounts - Infinite Parallel Clone App (Table Continues)	River Stone Tech	1,000,000

Table 74 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(do.multiple.cloner), v2.32.01.0426 (23201)		
BODY_SENSORS	Multi Parallel - Multiple Accounts & App Clone (multi.parallel.dualspace.cloner), v1.3.60.0427 (1360)	Winterfell Applab - Clone App & Status Downloader	1,000,000
	DO Multiple Accounts - Infinite Parallel Clone App (do.multiple.cloner), v2.32.01.0426 (23201)	River Stone Tech	1,000,000
RECEIVE_SMS	Phone (com.google.android.dialer), v48.0.308707326 (5602463)	Google LLC	100,000,000
ANSWER_PHONE_CALLS	Notepad - Write Notes, Checklists & Reminders (com.zfnstudio.notepad), v2.0.688 (16601)	Sappalodapps Development	10,000,000

Table 75 lists the 5 most popular Tools apps that requested the most permissions, whereas Table 76 lists the 5 most popular Tools apps that requested the fewest permissions.

Top 5 Apps	Developer	# of Installs	Permissions
DO Multiple Accounts - Infinite Parallel Clone App (do.multiple.cloner), v2.32.01.0426 (23201)	River Stone Tech	1,000,000	90
Multi Parallel - Multiple Accounts & App Clone (multi.parallel.dualspace.cloner), v1.3.60.0427 (1360)	Winterfell Applab - Clone App & Status Downloader	1,000,000	86
Samsung Smart Switch Mobile (com.sec.android.easyMover), v3.7.05.8 (370508100)	Samsung Electronics Co., Ltd.	100,000,000	65
Google (com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)	Google LLC	5,000,000,000	57
Avast Antivirus - Scan & Remove Virus, Cleaner (com.avast.android.mobilesecurity), v6.27.3 (323799)	Avast Software	100,000,000	51

Table 75: The 5 most popular Tools apps that requested the most permissions.

Top 5 Apps	Developer	# of Installs	Permissions
My Optus (au.com.optus.selfservice), v5.12 (454)	Optus Mobile Pty Ltd	1,000,000	2
OzBargain Free (com.minasolution.tools.ozbargainfree), v1.6.18 (39)	Minasolution	50,000	3
Spoilers Blocker (com.invariantlabs.spoilers), v1.0.6 (7)	Invariant Labs	10,000	3
Calculator (com.google.android.calculator), v7.8 (271241277) (78000303)	Google LLC	500,000,000	4
Digital Clock Widget (com.maize.digitalClock), v3.0.3 (88)	Maize	10,000,000	4

Table 76: The 5 most popular Tools apps that requested the least number of permissions.

D.2.2.2 Permission Usage While the previous subsection depicted the dangerous permissions *requested* by the apps that were tested, Table 77 lists the Tools apps based on the dangerous permissions that were observed being *used* during the testing period.

Table 77: Tools apps based on total number of permissions requested, the number of those that are considered “dangerous,” and the percentage of those dangerous permissions that were used during testing.

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
DO Multiple Accounts - Infinite Parallel Clone App (do.multiple.cloner), v2.32.01.0426 (23201)	River Stone Tech	90	14	14.3
Multi Parallel - Multiple Accounts & App Clone (multi.parallel.dualspace.cloner), v1.3.60.0427 (1360)	Winterfell Applab - Clone App & Status Downloader	86	14	14.3
Samsung Smart Switch Mobile (com.sec.android.easyMover), v3.7.05.8 (370508100)	Samsung Electronics Co., Ltd.	65	13	0.0
Google (com.google.android.googlequicksearchbox), v11.8.9.21.arm64 (301084796)	Google LLC	57	15	0.0
Avast Antivirus –Scan & Remove Virus, Cleaner (com.avast.android.mobilesecurity), v6.27.3 (323799)	Avast Software	51	12	0.0
AVG AntiVirus 2020 for Android Security Free (com.antivirus), v6.27.3 (323799)	AVG Mobile	49	11	0.0
Phone (com.google.android.dialer), v48.0.308707326 (5602463)	Google LLC	48	15	0.0
P Launcher 2020 new α (com.or.launcher.oreo), v6.3 (59)	N Dev Team	39	6	0.0
Super Security –Antivirus, AppLock, Virus Cleaner (com.ludashi.security), v2.1.7 (11)	DUALSPACE studio	38	7	0.0
Safe Security - Antivirus, Booster, Phone Cleaner (com.qihoo.security), v5.6.8.4831 (2599)	Safe Security Develop	37	10	0.0
Cleaner For Android :Phone Booster & RAM Optimizer (com.systweak.systemoptimizer), v7.9.9.31 (50)	SYSTWEAK SOFTWARE PRIVATE LIMITED	37	4	0.0
Super S9 Launcher for Galaxy S9/S8/S10 launcher (com.s9launcher.galaxy.launcher), v5.2 (47)	Super Launcher Serie	37	4	0.0
Elixir 2 - Widgets (com.bartat.android.elixir.widget), v2.43.3 (104)	Tamás Barta	36	4	0.0
Mobile Security & Antivirus (com.trendmicro.tmmpersonal), v11.3.0 (11302612)	Trend Micro	36	7	0.0
Phone Profiles Plus (sk.henrichg.phoneprofilesplus), v4.1.8.4 (5990)	Henrich Gron	31	7	0.0
Space Clean & Super Phone Cleaner (Table Continues)	DUALSPACE studio	31	5	0.0

Table 77 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(com.ludashi.superclean), v4.0.7 (47)				
Virus Cleaner - Antivirus, Booster & Phone Clean (antivirus.anti.virus.cleaner.security.booster), v1.3.5 (135)	Phone Clean Apps	30	7	0.0
AppLock - Fingerprint (com.sp.protector.free), v7.5.2 (194)	SpSoft	29	6	0.0
Powerful Cleaner (Boost&Clean) (com.powerful.cleaner), v3.0.22 (234)	Powerful cleaner dev	29	6	0.0
Boost+ Speed, Clean, Security (com.htc.pitroad), v1.90.1106613 (169081233)	HTC Corporation	28	3	0.0
Virus Cleaner-Antivirus, Phone Clean, Boost Master (virus.cleaner.antivirus.phone.security.boost), v1.3.3 (133)	Super Security Studio	28	5	0.0
搜狗输入法 (com.sohu.inputmethod.sogou), v8.31.6 (956)	Sogou.com Inc.	28	9	11.1
Clean Fast Pro -a smart & fast way to clean phone (com.clean.booster.junk.faster.cooler), v1.0.5 (5)	Deepcleaner Tech	27	4	0.0
KeepClean - Cleaner & Faster (com.appsinnova.android.keepclean), v2.1.2 (10002102)	APPS INNOVA	27	5	0.0
Sirius Cleaner - Phone Booster, CPU Cooler ,Cache (com.purifylbox.siriuscleaner), v1.2.0 (20)	purtify	27	4	25.0
Files by Google: Clean up space on your phone (com.google.android.apps.nbu.files), v1.0.302918309 (35547)	Google LLC	26	6	16.7
Safe Security - junk virus cleaner (com.antivirus.s.security.booster.speedup), v1.3.8 (12)	Paas Dev	24	3	0.0
APUS Security - Clean Virus, Antivirus, Booster (com.guardian.security.pri), v1.2.2 (206)	APUS Group	24	4	0.0
Google Go: A lighter, faster way to search (com.google.android.apps.searchlite), v3.6.308027732.release (233152)	Google LLC	23	9	0.0
Assistive Touch iOS 13 (com.luutinhit.assistivetouch), v2.3.6 (236)	LuuTinh Developer	23	2	0.0
Call Recorder - Automatic Call Recorder (call.recorder.automatic.acr), v2.0.6 (206)	Call Free, Caller ID, Call Recorder by Call Team	22	10	0.0
Fashion Wallpapers (com.fasyang.wallpaperproject), v1.0.8 (108)	Venice High	22	6	0.0
Fine Booster - Powerful Android Optimize Tool (com.fine.booster.carytool), v1.3.03 (1303)	For World Peace	22	5	0.0
Geek Cleaner - Easy & Smart Cleaner (com.geek.cleaner.francis.cony), v1.1.05 (1105)	Francis Team	22	5	0.0
Translate All - Speech Text Camera Translator (com.translate.all), v1.0.0 (100)	Translator Lab	21	8	0.0

(Table Continues)

Table 77 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(com.speech.text.translate), v1.6.1 (62)				
R.L. Wallpapers Flashlight&Compass (com.fla.wal.compas), v1.1.0 (110)	Dany iApp	21	6	0.0
Splendid Live Wallpapers (com.my.new.wallpaper.lww), v1.1.1 (111)	Thomass Lab	21	6	0.0
Superb Wallpapers Flashlight Compass all in one (com.tencent.fl.wallpaper), v1.0.4 (104)	Rocky Station	21	6	0.0
Control Center iOS 13 (com.luutihit.controlcenter), v2.9.6 (296)	LuuTinh Developer	21	4	0.0
Super Wallpapers Flashlight & Compass (com.wallpaper.flashlight.compass), v1.1.3 (113)	Rio Reader LLC	21	6	33.3
Color Wallpapers (com.play.lji.wallpapercomapss), v1.0.8 (108)	Creative Park Zone	21	6	33.3
Emoji keyboard - Cute Emoticons, GIF, Stickers (com.emoji.coolkeyboard), v3.4.2034 (203401)	Emoji Keyboard & Sticker Design Team	20	7	0.0
Powerful Flashlight (com.meituan.ybw.flash), v1.0.9 (109)	SR Media Market	20	6	0.0
iPlayer & iWallpaper (com.idl.videoedit.iwallpapers), v1.1.3 (113)	Hopesalive	20	7	0.0
Super Flashlight (com.superapp.xincheng), v1.0.8 (108)	Craig's Hub	20	6	0.0
Pulse Cleaner - Phone Booster & Optimizer (mobi.pulse.space.boost.cleaner), v1.0.39.200316 (39)	pulse app studio	20	2	0.0
My Vodafone (au.com.vodafone.mobile.gss), v4.0.29 (339033)	Vodafone Hutchison Australia Pty Ltd	20	9	22.2
My Telstra (com.telstra.mobile.android.mytelstra), v51.0.87 (101)	Telstra Corporation Ltd.	19	9	0.0
Memory cleaner. Speed booster & junk removal (com.junkremoval.pro), v1.0.14 (24)	essential tools	19	3	0.0
Editin Photos (com.aill.mycameras.imageedit), v1.1.0 (110)	Vanila iTech	19	6	50.0
Pedometer (com.baidu.news.pedometer), v1.1.1 (111)	Bright Star Lab	18	5	0.0
One Booster - Antivirus, Booster, Phone Cleaner (com.cleanteam.oneboost), v1.4.2.1 (1421)	One Family	18	4	0.0
Notepad - Write Notes, Checklists & Reminders (com.zfnstudio.notepad), v2.0.688 (16601)	Sappalodapps Development	18	9	22.2
One Security - Antivirus, Cleaner, Booster	One Family	17	4	0.0

(Table Continues)

Table 77 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(com.cleanteam.onesecurity), v1.0.9.0 (1090)				
Padenatéf (com.sun.newjbaq.beijing.ten), v1.0.2 (102)	Holmes Shop	17	5	0.0
Google Translate (com.google.android.apps.translate), v6.8.0.RC07.310451137 (68000765)	Google LLC	16	4	0.0
Virus Cleaner - Antivirus Free & Phone Cleaner (phone.antivirus.virus.cleaner.junk.clean.speed.booster.master), v1.1.10 (23)	Super Cleaner Studio	16	2	0.0
Phone Cleaner- Cache Clean, Android Booster Master (phone.cleaner.speed.booster.cache.clean.android.master), v1.3.7 (46)	Super Cleaner Studio	16	2	0.0
Aloha Browser - private fast browser with free VPN (com.alohamobile.browser), v2.16.4 (121445)	Aloha Mobile	15	6	0.0
Gboard - the Google Keyboard (com.google.android.inputmethod.latin), v9.3.12.308268050- release-arm64-v8a (26931226)	Google LLC	15	2	0.0
Norton App Lock (com.symantec.applock), v1.4.0.503 (503)	Norton Labs	15	5	0.0
Nielsen Mobile App (com.nielsen.odm), v8.1.5 (6972)	Nielsen Company	15	1	0.0
Bass Booster & Equalizer - Virtualizer (com.bass.boost.equalizer.music.pro), v1.0.6 (10006)	Emily Team	14	4	0.0
Memory Optimizer (com.vapp.memory_optimizer), v2.4 (19)	V D Apps	14	5	0.0
Network Monitor Mini (info.kfsoft.android.TrafficIndicator), v1.0.259 (259)	KF Software House	13	3	0.0
Lock screen password (com.green.banana.app.lockscreenpassword), v3.35.3384.118 (35)	Green Banana Studio	13	3	0.0
Simeji Japanese keyboard+Emoji (com.adamrocker.android.input.simeji), v14.5.2 (744)	バイトっ株式会社	12	2	0.0
Pie Control (jun.ace.piecontrol), v7.1.2 Sextans (72)	coolAce	12	2	0.0
SwiftRepost (insta.vidmateapp), v15.0 (30000115)	WS INFOTECH	12	3	0.0
Call Recorder (No Ads) (com.boldbeast.recorder), v13.2 (90)	Boldbeast Software Inc.	12	4	50.0
Google Authenticator (com.google.android.apps.authenticator2), v5.10 (5000100)	Google LLC	11	1	0.0

(Table Continues)

Table 77 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
Pixel Launcher (com.google.android.apps.nexuslauncher), v7.1.1-3862848 (151)	Google LLC	10	3	0.0
Service NSW (au.gov.nsw.service), v4.17.0 (88441) (118441)	Service NSW	10	3	0.0
Clock (com.google.android.deskclock), v6.2.1 (280557501) (62101012)	Google LLC	9	1	0.0
Phone Guardian Mobile Security & VPN Protection (com.distimo.phoneguardian), v2.8.1 (2020050113)	App Annie Basics	9	0	0.0
Private Downloader (com.mirmay.privatedownloader), v3.0.166 (166)	Mirmay Limited	9	3	0.0
Language Translator: Voice Translator, Interpreter (com.beldum.translator), v1.1.3 (13)	Beldum Studio	9	0	0.0
VPNhub Best Free Unlimited VPN - Secure WiFi Proxy (com.appatomic.vpnhub), v2.11.11-mobile (211111)	AppAtomic Limited	8	0	0.0
Message Text and Call Video Chat Free (com.messengerfree.forchat), v1.15 (16)	X-Game	8	0	0.0
무음카메라 (com.simpler.more.silencecamera), v1.2.03 (15)	More Simpler	8	0	0.0
DuckDuckGo Privacy Browser (com.duckduckgo.mobile.android), v5.53.1 (55301)	DuckDuckGo	7	1	0.0
Laban Key Go Tieng Viet (com.vng.inputmethod.labankey), v20.4.2 (20040261)	Zalo Group	7	3	0.0
Recovery all photo deleted (com.vttl.app7.restoreimages), v1.9 (10)	V TTL	7	3	0.0
Fullscreen Immersive - No Ads, No Root (immersive.duna.com.immersivemode), v3.4 (72)	PhotoSafe Inc.	7	0	0.0
Boost Master (com.rwasoft.booster), v3.6.0 (210)	Rwasoft	7	0	0.0
Ultimate Rotation Control (nl.fameit.rotate), v6.3.5 (Google) (6035)	FaMe IT	7	1	0.0
Farsi Keyboard (com.boloorian.android.farsikeyboard), v5.4 (64)	Khosrov Boloorian	6	0	0.0
Screen Time - Restrain yourself & parent control (master.app.screentime), v2.2.1 (120201)	IRIDIUM DUST LIMITED	6	0	0.0
SnapGrab - Private Screenshot Tool with Encryption (com.wathenwebworks.snapgrab), v3.2.3 (323)	Wathen Web Works	6	1	0.0
NordVPN -fast VPN app for privacy & security	NordVPN apps	6	0	0.0

(Table Continues)

Table 77 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(com.nordvpn.android), v4.12.5 (662)				
Calculator (com.google.android.calculator), v7.8 (271241277) (78000303)	Google LLC	4	0	0.0
Digital Clock Widget (com.maize.digitalClock), v3.0.3 (88)	Maize	4	1	0.0
Fast Cache Cleaner (jp.snowlife01.android.cache_delete), v2.2.0 (15)	HDM Dev Team	4	1	0.0
OzBargain Free (com.minasolution.tools.ozbargainfree), v1.6.18 (39)	Minasolution	3	0	0.0
Spoilers Blocker (com.invariantlabs.spoilers), v1.0.6 (7)	Invariant Labs	3	0	0.0
My Optus (au.com.optus.selfservice), v5.12 (454)	Optus Mobile Pty Ltd	2	0	0.0

D.2.3 Third-Party SDKs

We were able to identify 160 SDKs embedded within the 96 Tools apps. We list the 40 most common SDKs in Table 78,¹¹⁶ along with the number of Tools apps in which they were detected.

Table 78: The 40 most common SDKs identified within apps in the Tools category.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	86	(89.6%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	78	(81.2%)
Google Ads	Google	Advertisement	68	(70.8%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	58	(60.4%)
Google DoubleClick	Google	Advertisement	57	(59.4%)
Glide	Bump Technologies	Development Aid	51	(53.1%)
Google Gson	Google	Development Aid	50	(52.1%)
Facebook Ads	Facebook	Advertisement	48	(50.0%)
Facebook Analytics	Facebook	Mobile Analytics	38	(39.6%)
Facebook Login	Facebook	Digital Identity Advertisement Mobile Analytics	37	(38.5%)
Facebook Share	Facebook	Social Network Advertisement Mobile Analytics	34	(35.4%)
ZXing ('Zebra Crossing')	ZXing Project	Development Aid	30	(31.2%)
Github	Github	Development Aid	30	(31.2%)

(Table Continues)

¹¹⁶For an explanation of SDKs, see Section 4.1.2.

Table 78 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Moat	Oracle	Mobile Analytics	30	(31.2%)
Crashlytics	Google	Mobile Analytics	29	(30.2%)
Google Play	Google Play	App Market	27	(28.1%)
Facebook Places	Facebook	Map/LBS Advertisement	27	(28.1%)
Integral Ad Science	Integral Ad Science Inc.	Mobile Analytics Advertisement AdFraud	25	(26.0%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	24	(25.0%)
MoPub	Twitter	Advertisement	21	(21.9%)
Unity3D	Unity Technologies	Game Engine Mobile Analytics Advertisement	19	(19.8%)
Google Protocol Buffers	Google	Development Aid	18	(18.8%)
Google Analytics	Google	Mobile Analytics	18	(18.8%)
Unity3d Ads	Unity Technologies	Advertisement	18	(18.8%)
Apache Http	The Apache Software Founda- tion	Development Aid	16	(16.7%)
Applovin	AppLovin	Advertisement	16	(16.7%)
Amazon Advertisement	Amazon	Advertisement	15	(15.6%)
Ogury Presage	Ogury	Advertisement	15	(15.6%)
Fastjson	Alibaba.com	Development Aid	15	(15.6%)
Google Core Libraries for Java 6+	Google	Development Aid	14	(14.6%)
Apache Common	The Apache Software Founda- tion	Development Aid	14	(14.6%)
picasso	Square Inc.	Development Aid	14	(14.6%)
AdColony	AdColony	Advertisement	14	(14.6%)
ChartBoost	Chartboost	Advertisement	13	(13.5%)
IronSource	IronSource	Advertisement	13	(13.5%)

(Table Continues)

Table 78 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
		Mobile Analytics		
Tapjoy	Tapjoy	Advertisement	13	(13.5%)
Vungle	Vungle	Advertisement	13	(13.5%)
Volley HTTP library	Google	Development Aid Networking	12	(12.5%)
Google Tag Manager	Google	Mobile Analytics	11	(11.5%)
Adincube	Ogury	Advertisement	11	(11.5%)

Several of these SDKs included developer tools, which we characterize as SDKs that provide tools and functionality to app developers which are unlikely to be used for the transmission of user information. As a result, we separately present Table 79, which depicts the 40 most common SDKs with developer tools removed, along with the number of Tools apps in which they were detected.

Table 79: The 40 most common SDKs identified within apps in the Tools category, with developer tools removed.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	86	(89.6%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	78	(81.2%)
Google Ads	Google	Advertisement	68	(70.8%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	58	(60.4%)
Google DoubleClick	Google	Advertisement	57	(59.4%)

(Table Continues)

Table 79 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Facebook Ads	Facebook	Advertisement	48	(50.0%)
Facebook Analytics	Facebook	Mobile Analytics	38	(39.6%)
Facebook Login	Facebook	Digital Identity Advertisement Mobile Analytics	37	(38.5%)
Facebook Share	Facebook	Social Network Advertisement Mobile Analytics	34	(35.4%)
Moat	Oracle	Mobile Analytics	30	(31.2%)
Crashlytics	Google	Mobile Analytics	29	(30.2%)
Google Play	Google Play	App Market	27	(28.1%)
Facebook Places	Facebook	Map/LBS Advertisement	27	(28.1%)
Integral Ad Science	Integral Ad Science Inc.	Mobile Analytics Advertisement AdFraud	25	(26.0%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	24	(25.0%)
MoPub	Twitter	Advertisement	21	(21.9%)
Unity3D	Unity Technologies	Game Engine Mobile Analytics Advertisement	19	(19.8%)
Google Analytics	Google	Mobile Analytics	18	(18.8%)
Unity3d Ads	Unity Technologies	Advertisement	18	(18.8%)
Applovin	AppLovin	Advertisement	16	(16.7%)
Amazon Advertisement	Amazon	Advertisement	15	(15.6%)
Ogury Presage	Ogury	Advertisement	15	(15.6%)
AdColony	AdColony	Advertisement	14	(14.6%)
ChartBoost	Chartboost	Advertisement	13	(13.5%)
IronSource	IronSource	Advertisement	13	(13.5%)

(Table Continues)

Table 79 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
		Mobile Analytics		
Tapjoy	Tapjoy	Advertisement	13	(13.5%)
Vungle	Vungle	Advertisement	13	(13.5%)
Volley HTTP library	Google	Development Aid Networking	12	(12.5%)
Google Tag Manager	Google	Mobile Analytics	11	(11.5%)
Adincube	Ogury	Advertisement	11	(11.5%)
Umeng Analytics	Alibaba	Mobile Analytics	10	(10.4%)
Smaato	Smaato	Advertisement LBS	9	(9.4%)
Flurry	Verizon	Mobile Analytics	6	(6.2%)
AppMonet	Monet Engine Inc.	Advertisement	6	(6.2%)
Inmobi	InMobi	Advertisement	5	(5.2%)
Fyber	Fyber	Advertisement	4	(4.2%)
getui	getui	Advertisement Mobile Analytics Push Notifications	4	(4.2%)
Tencent Login	Tencent	Social Network	3	(3.1%)
AdSDK	MobFox	Advertisement	3	(3.1%)
PubNative	PubNative	Advertisement	3	(3.1%)

D.3 Communication Apps

D.3.1 Data Types Transmitted

Apps in the Communication category were observed transmitting the data types listed in Table 80 during the testing period.¹¹⁷

Data Type	# of Apps	(% of Apps)
AAID	39	(52.0%)
Android ID	25	(33.3%)
WiFi MAC	5	(6.7%)
IMEI	5	(6.7%)
Email	4	(5.3%)
GPS Location	2	(2.7%)
Coarse Location	2	(2.7%)
Name	1	(1.3%)
IMSI	1	(1.3%)
BT Name	1	(1.3%)
WiFi SSID	1	(1.3%)

Table 80: Data types transmitted by apps in the Communication category during the testing period.

¹¹⁷For an explanation of these data types, see Section 3.

D.3.1.1 Most Common Hostnames Contacted

Table 81 depicts the top 10 hostnames observed being contacted by Communication apps during the testing period, whereas Table 82 depicts the top 10 parent companies corresponding to these hostnames. This data reflects Internet servers that were *contacted* by apps, but does not necessarily mean that they received sensitive user information—we specifically discuss that subset of recipients in Section D.3.1.2.¹¹⁸ The discrepancy between the two sections is due to the fact that some app transmissions may simply not contain sensitive user information or that its transmission was obfuscated using a method that we did not immediately recognize.

Hostname	Parent Company	# of Apps	(% of Apps)
settings.crashlytics.com	Google	28	(37.3%)
graph.facebook.com	Facebook	21	(28.0%)
googleads.g.doubleclick.net	Google	15	(20.0%)
firebaseremoteconfig.googleapis.com	Google	14	(18.7%)
www.facebook.com	Facebook	13	(17.3%)
data.flurry.com	Verizon	11	(14.7%)
firebaseinstallations.googleapis.com	Google	10	(13.3%)
lh3.googleusercontent.com	Google	10	(13.3%)
app.adjust.com	Adjust	9	(12.0%)
t.appsflyer.com	AppsFlyer	9	(12.0%)

Table 81: The top 10 most common hostnames contacted by Communication apps during testing.

Company	# of Apps	(% of Apps)
Google	52	(69.3%)
Facebook	25	(33.3%)
Verizon	14	(18.7%)
AppsFlyer	11	(14.7%)
Microsoft	9	(12.0%)
Adjust	9	(12.0%)
Twitter	8	(10.7%)
Liftoff	6	(8.0%)
Leanplum	4	(5.3%)
1und1	3	(4.0%)

¹¹⁸We define “user information” in Section 3.

Company	# of Apps	(% of Apps)
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Table 82: The top 10 most common companies contacted by Communication apps during testing.

D.3.1.2 Most Common Data Recipients

Table 83 depicts the top 10 data recipients among the Communication apps during the testing period. Table 84 lists additional information about the most common data recipients, such as the approximate locations of their servers, IP addresses contacted during testing, and the types of sensitive user information that we observed them receive during the testing period.

Hostname	Parent Company	# of Apps	(% of Apps)
graph.facebook.com	Facebook	20	(26.7%)
data.flurry.com	Verizon	11	(14.7%)
app.adjust.com	Adjust	9	(12.0%)
t.appsflyer.com	AppsFlyer	9	(12.0%)
www.facebook.com	Facebook	9	(12.0%)
ads.mopub.com	Twitter	4	(5.3%)
analytics.query.yahoo.com	Verizon	3	(4.0%)
settings.crashlytics.com	Google	2	(2.7%)
tracker-api.my.com	myTracker	2	(2.7%)
aj-https.my.com	myTracker	2	(2.7%)

Table 83: The top 10 most common data recipients from Communication apps during testing.

Table 84: The 10 most common recipient hostnames of user information from Communication apps during the testing period, along with their IP addresses, company information, and the data types that were observed being transmitted.

Parent Company	Country	IPs	Received Data
<code>graph.facebook.com</code>			
Facebook	United States	157.240.8.18 (US)	Android ID AAID IMEI
<code>data.flurry.com</code>			
Verizon	United States	115.178.9.19 (HK) 115.178.9.18 (HK)	Android ID AAID IMEI
<code>app.adjust.com</code>			
Adjust	United States	185.151.204.11 (DE) 185.151.204.12 (DE) 185.151.204.13 (DE) 185.151.204.7 (DE) 185.151.204.9 (DE) 185.151.204.6 (DE) 185.151.204.10 (DE)	Android ID AAID
<code>t.appsflyer.com</code>			
AppsFlyer	United States	18.203.142.180 (IE) 34.251.147.251 (IE) 34.255.47.88 (IE) 34.254.133.56 (IE) 52.51.68.191 (IE) 54.171.33.138 (IE) 34.250.242.46 (IE) 52.17.3.182 (IE) 54.154.217.112 (IE)	Android ID AAID
<code>www.facebook.com</code>			
Facebook	United States	157.240.8.35 (US)	AAID
<code>ads.mopub.com</code>			
Twitter	United States	192.48.236.11 (US) 192.48.236.12 (US) 192.48.236.10 (US)	AAID

(Table Continues)

Table 84 (Continued)

Parent Company	Country	IPs	Received Data
analytics.query.yahoo.com			
Verizon	United States	119.161.10.12 (KR) 119.161.10.11 (KR)	AAID
tracker-api.my.com			
myTracker	Russia	185.30.176.220 (NL)	Android ID AAID WiFi MAC Email
aj-https.my.com			
myTracker	Russia	185.30.179.6 (NL)	Android ID AAID Email
control.kochava.com			
Kochava	United States	107.178.254.148 (US)	Android ID AAID

D.3.1.3 Apps Ranked by Number of Recipients

Table 85 ranks the Communication apps based on the number of recipients to which we detected each transmit sensitive user information during testing.

Table 85: Communication apps ordered by the number of recipients (by unique hostnames and their parent companies) during the testing period.

App	Developer	Installs	Recipients	
			Hostnames	Companies
Email App for Any Mail Package Name: park.outlook.sign.in.client Version: 11.13.1.29164 (29164)	Craigpark Limited	5,000,000	11	6
PlayStation Messages - Check your online friends Package Name: com.playstation.mobilemessenger Version: 20.01.5.11295 (435)	PlayStation Mobile Inc.	10,000,000	5	5
Messenger for SMS Package Name: com.link.messages.sms Version: 2.2.9 (229)	SMS Messenger	10,000,000	8	5
Connect for Hotmail & Outlook: Mail and Calendar Package Name: com.connectivityapps.hotmail Version: 5.3.5 (37)	Connectivity Apps	5,000,000	5	5
Social Messenger: Free Mobile Calling, Live Chats Package Name: com.messagingnew.allinone Version: 8.0 (83)	CanAli	5,000,000	5	5
Privacy Messenger - Private SMS messages, Call app Package Name: com.melonsapp.privacymessenger Version: 5.7.8 (624)	Melons Messenger Inc.	1,000,000	5	5
Messenger : All-in-One Messaging & Video Calling Package Name: messengerchat-app.new17.update2017 Version: 4.5 (27)	Halliv Mobiles by Oak pro	1,000,000	6	5
UC Browser- Free & Fast Video Downloader, News App Package Name: com.UCMobile.intl Version: 13.1.2.1293 (50105)	UCWeb Singapore Pte. Ltd.	500,000,000	5	4
myMail –Email for Hotmail, Gmail and Outlook Mail Package Name: com.my.mail Version: 12.1.1.29709 (29709)	My.com B.V.	10,000,000	8	4
Call Free : Free Call & Free Text Package Name: call.free.international.phone.call Version: 1.7.5 (175)	Call Free, Caller ID, Call Recorder by Call Team	10,000,000	6	4
Messenger app, Light All-in-One, Live Free Chat Package Name: comm.essagechat.listing	Palinka Apps	1,000,000	4	4

(Table Continues)

Table 85 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Version: 17.0 (17) TextU - Private SMS Messenger, Call app Package Name: com.textu.sms.privacy.messenger Version: 4.2.8 (708)	Melons Chat Group	100,000	5	4
Kik Package Name: kik.android Version: 15.22.0.22321 (30000549)	Kik Interactive	100,000,000	4	3
Opera browser with free VPN Package Name: com.opera.browser Version: 57.2.2830.52651 (1905713603)	Opera	100,000,000	7	3
Opera Mini - fast web browser Package Name: com.opera.mini.native Version: 47.2.2254.147957 (473147957)	Opera	100,000,000	6	3
CallApp: Caller ID, Call Blocker & Call Recorder Package Name: com.callapp.contacts Version: 1.620 (1620)	CallApp Caller ID, Manage & Customize your calls	50,000,000	4	3
Viber Messenger - Messages, Group Chats & Calls Package Name: com.viber.voip Version: 12.9.5.2 (640529)	Viber Media S.à r.l.	500,000,000	2	2
Truecaller: Caller ID, block robocalls & spam SMS Package Name: com.truecaller Version: 11.4.6 (1104006)	True Software Scandinavia AB	500,000,000	3	2
imo free video calls and chat Package Name: com.imo.android.imoim Version: 2020.04.2041 (20042041)	imo.im	500,000,000	2	2
Yahoo Mail –Organized Email Package Name: com.yahoo.mobile.client.android.mail Version: 6.7.1 (1454180)	Yahoo	100,000,000	6	2
Zalo - Video Call Package Name: com.zing.zalo Version: 20.04.02 (12100501)	Zalo Group	100,000,000	3	2
imo beta free calls and text Package Name: com.imo.android.imoibeta Version: 2020.05.1022 (20051022)	imo.im	100,000,000	2	2
Microsoft Edge Package Name: com.microsoft.emmx Version: 45.03.4.4955 (4955004)	Microsoft Corporation	10,000,000	4	2
Free Adblocker Browser - Adblock & Popup Blocker Package Name: com.hsv.freeadblockerbrowser Version: 72.0.2016123225 (2016123225)	Adblock - Rocketshield Browser Technology Limited	10,000,000	2	2
GMX - Mail & Cloud	GMX (Table Continues)	10,000,000	3	2

Table 85 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Package Name: de.gmx.mobile.android.mail Version: 6.14.3 (404258)				
Ring - Always Home Package Name: com.ringapp Version: 3.25.0 (26452333)	Ring.com	5,000,000	7	2
Dolphin Jetpack - Fast & Flash Package Name: com.dolphin.browser.engine Version: 7.3.1 (210)	Dolphin Browser	1,000,000	3	2
Screen Cut -Best Screenshot Capture & Crop app Package Name: mobi.mgeek.ScreenCut Version: 3.4 (23)	Dolphin Browser	1,000,000	2	2
Gmail Package Name: com.google.android.gm Version: 2020.04.12.307915656.Release (62161216)	Google LLC	5,000,000,000	1	1
Messenger Lite: Free Calls & Messages Package Name: com.facebook.mlite Version: 86.0.1.3.126 (212855351)	Facebook	500,000,000	1	1
KakaoTalk: Free Calls & Text Package Name: com.kakao.talk Version: 8.8.5 (1908851)	Kakao Corporation	100,000,000	4	1
Discord - Friends, Communities, & Gaming Package Name: com.discord Version: 21.3 (1133)	Discord Inc.	100,000,000	1	1
Firefox Browser: fast, private & safe web browser Package Name: org.mozilla.firefox Version: 68.8.0 (2015695963)	Mozilla	100,000,000	1	1
Puffin Web Browser Package Name: com.cloudmosa.puffinFree Version: 8.3.0.41446 (10041446)	CloudMosa, Inc.	50,000,000	1	1
Firefox for Android Beta Package Name: org.mozilla.firefox_beta Version: 75.0.0-beta.6 (2015735819)	Mozilla	10,000,000	1	1
Textra SMS Package Name: com.textra Version: 4.25 (42590)	Delicious	10,000,000	1	1
WEB.DE Mail & Cloud Package Name: de.web.mobile.android.mail Version: 6.14.3 (404256)	WEB.DE	10,000,000	2	1
다음 - Daum Package Name: net.daum.android.daum Version: 6.9.13 (348)	Kakao Corp.	10,000,000	2	1

(Table Continues)

Table 85 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Phone + Contacts and Calls Package Name: v.d.d.answercall Version: 3.7.0 (37077)	FUG	10,000,000	1	1
Firefox Focus: The privacy browser Package Name: org.mozilla.focus Version: 8.3.0 (341281936)	Mozilla	5,000,000	1	1
Ecosia - Trees & Privacy Package Name: com.ecosia.android Version: 3.7.8 (175)	Ecosia.org	5,000,000	1	1
mail.com mail Package Name: com.mail.mobile.android.mail Version: 6.14.3 (404252)	1&1 Mail & Media Inc	1,000,000	1	1
Handcent Next SMS (Best texting with MMS,stickers) Package Name: com.handcent.app.nextsms Version: 8.9.6.4 (40809609)	Handcent	1,000,000	2	1
Messenger SMS & MMS Package Name: sms.mms.messages.text.free Version: 17.0 (17)	Share File Technologies	1,000,000	1	1
Habit Browser Package Name: jp.ddo.pigsty.HabitBrowser Version: 1.1.77 (269)	mura.k	500,000	1	1
Google Chrome: Fast & Secure Package Name: com.android.chrome Version: 81.0.4044.138 (404413823)	Google LLC	5,000,000,000	0	0
WhatsApp Messenger Package Name: com.whatsapp Version: 2.20.157 (453599)	WhatsApp Inc.	5,000,000,000	0	0
Hangouts Package Name: com.google.android.talk Version: 33.0.303435107 (26266320)	Google LLC	1,000,000,000	0	0
Messenger -Text and Video Chat for Free Package Name: com.facebook.orca Version: 263.1.0.35.125 (212938274)	Facebook	1,000,000,000	0	0
Samsung Internet Browser Package Name: com.sec.android.app.sbrowser Version: 11.2.1.3 (1112103502)	Samsung Electronics Co., Ltd.	1,000,000,000	0	0
Messages Package Name: com.google.android.apps.messaging Version: 5.9.099 (Wyvern_RC10.phone_dynamic) (59099000)	Google LLC	1,000,000,000	0	0
Skype - free IM & video calls	Skype (Table Continues)	1,000,000,000	0	0

Table 85 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Package Name: com.skype.raider Version: 8.59.0.77 (1250090458)				
Google Duo - High Quality Video Calls Package Name: com.google.android.apps.tachyon Version: 91.0.315322534.DR91_RC03 (3014415)	Google LLC	1,000,000,000	0	0
LINE: Free Calls & Messages Package Name: jp.naver.line.android Version: 10.6.2 (100620147)	LINE Corporation	500,000,000	0	0
Telegram Package Name: org.telegram.messenger Version: 6.1.1 (19477)	Telegram FZ-LLC	500,000,000	0	0
Contacts Package Name: com.google.android.contacts Version: 3.22.4.309864854 (2390446)	Google LLC	100,000,000	0	0
WeChat Package Name: com.tencent.mm Version: 7.0.13 (1621)	WeChat	100,000,000	0	0
WhatsApp Business Package Name: com.whatsapp.w4b Version: 2.20.49 (826)	WhatsApp Inc.	100,000,000	0	0
Signal Private Messenger Package Name: org.thoughtcrime.securesms Version: 4.59.9 (6292)	Signal Foundation	10,000,000	0	0
QQ Package Name: com.tencent.mobileqq Version: 8.2.9 (1353)	Tencent Technology (Shenzhen) Company Ltd.	10,000,000	0	0
Brave Private Browser: Fast, safe web browser Package Name: com.brave.browser Version: 1.8.93 (410809323)	Brave Software	10,000,000	0	0
K-9 Mail Package Name: com.fsck.k9 Version: 5.600 (26000)	K-9 Dog Walkers	5,000,000	0	0
Mobile operators Package Name: com.glebzakaev.mobilecarriers Version: 2.22 (546)	Gleb Zakaev	1,000,000	0	0
TypeApp mail - email app Package Name: com.trff.blue Version: 1.9.7.32 (15857)	TypeApp LLC	1,000,000	0	0
Kiwi Browser - Fast & Quiet Package Name: com.kiwibrowser.browser Version: Quadea (159)	Geometry OU	1,000,000	0	0

(Table Continues)

Table 85 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Swarachakra Tamil Keyboard Package Name: iit.android.swarachakraTamil Version: 2.01 (20)	Swarachakra Team, IDC, IIT Bombay	1,000,000	0	0
Naver Whale Browser Package Name: com.naver.whale Version: 1.4.3.2 (1055)	NAVER Corp.	1,000,000	0	0
ScribMaster draw and paint Package Name: net.thoster.noteshare Version: 2018.2 (78)	Alstapp Note & Draw	500,000	0	0
Free VPN - VPN4Test Package Name: com.free.vpntest Version: 1.0.5 (14)	Ice Wall	100,000	0	0
Hear Boost: Enhanced Microphone Volume & Recording Package Name: com.audiofix.hearboost Version: 1.26 (26)	Future Moments	100,000	0	0
Email for Outlook & Hotmail: Fast, Easy & Secure Package Name: com.emailclient.mailchecker.outlook.hotmail Version: 1.17 (18)	HBSolution Inc.	100,000	0	0
Dolphin Tab Reload Package Name: mobi.mgeek.tabreload Version: 1.5.2 (8)	Dolphin Browser Add-ons □	100,000	0	0
Dolphin Tab Switcher Package Name: mobi.mgeek.tabswitcher Version: 2.0 (6)	Dolphin Browser Add-ons □	100,000	0	0
Velocity Browser - Private Browser Package Name: com.hindbyte.velocity Version: 1.5.0 (50)	Hindbyte Group	10,000	0	0
Fastest Browser - Fast Download Private & Safe Package Name: com.ap.pacorporation.litebrowse Version: 1.1 (2)	pacorporation	1,000	0	0

D.3.1.4 Popular Apps Transmitting Each Data Type

For each of these data types, Table 86 lists the top 5 most popular Communication apps that we observed transmitting them during testing.¹¹⁹

Table 86: The top 5 Communication apps that we detected transmitting each data type during the testing period.

Data Type	Top 5 Apps	Developer	# of Installs
AAID	Viber Messenger - Messages, Group Chats & Calls (com.viber.voip), v12.9.5.2 (640529)	Viber Media S.à r.l.	500,000,000
	Truecaller: Caller ID, block robocalls & spam SMS (com.truecaller), v11.4.6 (1104006)	True Software Scandinavia AB	500,000,000
	imo free video calls and chat (com.imo.android.imoim), v2020.04.2041 (20042041)	imo.im	500,000,000
	UC Browser- Free & Fast Video Downloader, News App (com.UCMobile.intl), v13.1.2.1293 (50105)	UCWeb Singapore Pte. Ltd.	500,000,000
	Kik (kik.android), v15.22.0.22321 (30000549)	Kik Interactive	100,000,000
Android ID	Messenger Lite: Free Calls & Messages (com.facebook.mlite), v86.0.1.3.126 (212855351)	Facebook	500,000,000
	UC Browser- Free & Fast Video Downloader, News App (com.UCMobile.intl), v13.1.2.1293 (50105)	UCWeb Singapore Pte. Ltd.	500,000,000
	Kik (kik.android), v15.22.0.22321 (30000549)	Kik Interactive	100,000,000
	Opera Mini - fast web browser (com.opera.mini.native), v47.2.2254.147957 (473147957)	Opera	100,000,000
	CallApp: Caller ID, Call Blocker & Call Recorder (com.callapp.contacts), v1.620 (1620)	CallApp Caller ID, Manage & Customize your calls	50,000,000
WiFi MAC	UC Browser- Free & Fast Video Downloader, News App (com.UCMobile.intl), v13.1.2.1293 (50105)	UCWeb Singapore Pte. Ltd.	500,000,000
	Messenger for SMS (com.link.messages.sms), v2.2.9 (229)	SMS Messenger	10,000,000
	myMail -Email for Hotmail, Gmail and Outlook Mail (com.my.mail), v12.1.1.29709 (29709)	My.com B.V.	10,000,000
	Email App for Any Mail (park.outlook.sign.in.client), v11.13.1.29164 (29164)	Craigpark Limited	5,000,000
	Handcent Next SMS (Best texting with MMS,stickers) (com.handcent.app.nextsms), v8.9.6.4 (40809609)	Handcent	1,000,000

(Table Continues)

¹¹⁹Popularity is determined by the number of reported installs in the Google Play Store.

Table 86 (Continued)

Data Type	Top 5 Apps	Developer	# of Installs
IMEI	Zalo - Video Call (com.zing.zalo), v20.04.02 (12100501)	Zalo Group	100,000,000
	Messenger for SMS (com.link.messages.sms), v2.2.9 (229)	SMS Messenger	10,000,000
	Privacy Messenger - Private SMS messages, Call app (com.melonsapp.privacymessenger), v5.7.8 (624)	Melons Messenger Inc.	1,000,000
	Handcent Next SMS (Best texting with MMS,stickers) (com.handcent.app.nextsms), v8.9.6.4 (40809609)	Handcent	1,000,000
	TextU - Private SMS Messenger, Call app (com.textu.sms.privacy.messenger), v4.2.8 (708)	Melons Chat Group	100,000
Email	Gmail (com.google.android.gm), v2020.04.12.307915656.Release (62161216)	Google LLC	5,000,000,000
	Kik (kik.android), v15.22.0.22321 (30000549)	Kik Interactive	100,000,000
	Ring - Always Home (com.ringapp), v3.25.0 (26452333)	Ring.com	5,000,000
	Email App for Any Mail (park.outlook.sign.in.client), v11.13.1.29164 (29164)	Craigpark Limited	5,000,000
GPS Location	Free Adblocker Browser - Adblock & Popup Blocker (com.hsv.freeadblockerbrowser), v72.0.2016123225 (2016123225)	Adblock - Rocketshield Browser Technology Limited	10,000,000
	Ring - Always Home (com.ringapp), v3.25.0 (26452333)	Ring.com	5,000,000
Coarse Location	Free Adblocker Browser - Adblock & Popup Blocker (com.hsv.freeadblockerbrowser), v72.0.2016123225 (2016123225)	Adblock - Rocketshield Browser Technology Limited	10,000,000
	Ring - Always Home (com.ringapp), v3.25.0 (26452333)	Ring.com	5,000,000
Name	Gmail (com.google.android.gm), v2020.04.12.307915656.Release (62161216)	Google LLC	5,000,000,000
IMSI	Handcent Next SMS (Best texting with MMS,stickers) (Table Continues)	Handcent	1,000,000

Table 86 (Continued)

Data Type	Top 5 Apps	Developer	# of Installs
	(com.handcent.app.nextsms), v8.9.6.4 (40809609)		
BT Name	Handcent Next SMS (Best texting with MMS,stickers) (com.handcent.app.nextsms), v8.9.6.4 (40809609)	Handcent	1,000,000
WiFi SSID	Handcent Next SMS (Best texting with MMS,stickers) (com.handcent.app.nextsms), v8.9.6.4 (40809609)	Handcent	1,000,000

Table 87 lists the 5 most popular Communication apps that transmitted the most data types during the testing period, whereas Table 88 lists the 5 most popular Communication apps that transmitted the fewest data types during the testing period.

Top 5 Apps	Developer	# of Installs	Data Types
Handcent Next SMS (Best texting with MMS,stickers) (com.handcent.app.nextsms), v8.9.6.4 (40809609)	Handcent	1,000,000	6
Messenger for SMS (com.link.messages.sms), v2.2.9 (229)	SMS Messenger	10,000,000	4
Ring - Always Home (com.ringapp), v3.25.0 (26452333)	Ring.com	5,000,000	4
Email App for Any Mail (park.outlook.sign.in.client), v11.13.1.29164 (29164)	Craigpark Limited	5,000,000	4
UC Browser- Free & Fast Video Downloader, News App (com.UCMobile.intl), v13.1.2.1293 (50105)	UCWeb Singapore Pte. Ltd.	500,000,000	3

Table 87: The top 5 Communication apps that transmitted the most data types during testing.

Top 5 Apps	Developer	# of Installs	Data Types
Google Chrome: Fast & Secure (com.android.chrome), v81.0.4044.138 (404413823)	Google LLC	5,000,000,000	0
WhatsApp Messenger (com.whatsapp), v2.20.157 (453599)	WhatsApp Inc.	5,000,000,000	0
Hangouts (com.google.android.talk), v33.0.303435107 (26266320)	Google LLC	1,000,000,000	0
Messenger –Text and Video Chat for Free (com.facebook.orca), v263.1.0.35.125 (212938274)	Facebook	1,000,000,000	0
Samsung Internet Browser (com.sec.android.app.sbrowser), v11.2.1.3 (1112103502)	Samsung Electronics Co., Ltd.	1,000,000,000	0

Table 88: The top 5 Communication apps that transmitted the fewest data types during testing.

D.3.2 App Permissions

Apps in the Communication category requested the dangerous permissions listed in Table 89.¹²⁰

Data Type	# of Apps	(% of Apps)
WRITE_EXTERNAL_STORAGE	68	(90.7%)
READ_EXTERNAL_STORAGE	61	(81.3%)
CAMERA	52	(69.3%)
GET_ACCOUNTS	49	(65.3%)
RECORD_AUDIO	46	(61.3%)
READ_CONTACTS	46	(61.3%)
ACCESS_FINE_LOCATION	43	(57.3%)
ACCESS_COARSE_LOCATION	43	(57.3%)
WRITE_CONTACTS	39	(52.0%)
READ_PHONE_STATE	38	(50.7%)
CALL_PHONE	26	(34.7%)
SEND_SMS	15	(20.0%)
RECEIVE_SMS	14	(18.7%)
READ_SMS	14	(18.7%)
RECEIVE_MMS	12	(16.0%)
READ_CALL_LOG	9	(12.0%)
WRITE_CALENDAR	7	(9.3%)
READ_CALENDAR	7	(9.3%)
PROCESS_OUTGOING_CALLS	7	(9.3%)
WRITE_CALL_LOG	7	(9.3%)
ANSWER_PHONE_CALLS	5	(6.7%)
RECEIVE_WAP_PUSH	3	(4.0%)
READ_PHONE_NUMBERS	2	(2.7%)
BODY_SENSORS	1	(1.3%)
ACTIVITY_RECOGNITION	1	(1.3%)
ACCESS_MEDIA_LOCATION	1	(1.3%)
ACCESS_BACKGROUND_LOCATION	1	(1.3%)

Table 89: Dangerous permissions requested by apps in the Communication category.

¹²⁰For an explanation of dangerous permissions, see Section 4.3.

D.3.2.1 Popular Apps Requesting Dangerous Permissions For each of these permissions, Table 90 lists the top 5 most popular apps that we observed requesting dangerous permissions during testing.¹²¹

Table 90: The 5 most popular Communication apps that requested each dangerous permission.

Permission	Top 5 Apps	Developer	# of Installs
WRITE_EXTERNAL_STORAGE			
	Google Chrome: Fast & Secure (com.android.chrome), v81.0.4044.138 (404413823)	Google LLC	5,000,000,000
	Gmail (com.google.android.gm), v2020.04.12.307915656.Release (62161216)	Google LLC	5,000,000,000
	WhatsApp Messenger (com.whatsapp), v2.20.157 (453599)	WhatsApp Inc.	5,000,000,000
	Hangouts (com.google.android.talk), v33.0.303435107 (26266320)	Google LLC	1,000,000,000
	Messenger –Text and Video Chat for Free (com.facebook.orca), v263.1.0.35.125 (212938274)	Facebook	1,000,000,000
READ_EXTERNAL_STORAGE			
	Google Chrome: Fast & Secure (com.android.chrome), v81.0.4044.138 (404413823)	Google LLC	5,000,000,000
	Gmail (com.google.android.gm), v2020.04.12.307915656.Release (62161216)	Google LLC	5,000,000,000
	WhatsApp Messenger (com.whatsapp), v2.20.157 (453599)	WhatsApp Inc.	5,000,000,000
	Hangouts (com.google.android.talk), v33.0.303435107 (26266320)	Google LLC	1,000,000,000
	Messenger –Text and Video Chat for Free (com.facebook.orca), v263.1.0.35.125 (212938274)	Facebook	1,000,000,000
CAMERA			
	Google Chrome: Fast & Secure (com.android.chrome), v81.0.4044.138 (404413823)	Google LLC	5,000,000,000
	Gmail (com.google.android.gm), v2020.04.12.307915656.Release (62161216)	Google LLC	5,000,000,000
	WhatsApp Messenger (com.whatsapp), v2.20.157 (453599)	WhatsApp Inc.	5,000,000,000
	Hangouts (com.google.android.talk), v33.0.303435107 (26266320)	Google LLC	1,000,000,000

(Table Continues)

¹²¹ Popularity is determined by the number of reported installs in the Google Play Store.

Table 90 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	Messenger –Text and Video Chat for Free (com.facebook.orca), v263.1.0.35.125 (212938274)	Facebook	1,000,000,000
GET_ACCOUNTS			
	Google Chrome: Fast & Secure (com.android.chrome), v81.0.4044.138 (404413823)	Google LLC	5,000,000,000
	Gmail (com.google.android.gm), v2020.04.12.307915656.Release (62161216)	Google LLC	5,000,000,000
	WhatsApp Messenger (com.whatsapp), v2.20.157 (453599)	WhatsApp Inc.	5,000,000,000
	Hangouts (com.google.android.talk), v33.0.303435107 (26266320)	Google LLC	1,000,000,000
	Messenger –Text and Video Chat for Free (com.facebook.orca), v263.1.0.35.125 (212938274)	Facebook	1,000,000,000
RECORD_AUDIO			
	Google Chrome: Fast & Secure (com.android.chrome), v81.0.4044.138 (404413823)	Google LLC	5,000,000,000
	Gmail (com.google.android.gm), v2020.04.12.307915656.Release (62161216)	Google LLC	5,000,000,000
	WhatsApp Messenger (com.whatsapp), v2.20.157 (453599)	WhatsApp Inc.	5,000,000,000
	Hangouts (com.google.android.talk), v33.0.303435107 (26266320)	Google LLC	1,000,000,000
	Messenger –Text and Video Chat for Free (com.facebook.orca), v263.1.0.35.125 (212938274)	Facebook	1,000,000,000
READ_CONTACTS			
	Gmail (com.google.android.gm), v2020.04.12.307915656.Release (62161216)	Google LLC	5,000,000,000
	WhatsApp Messenger (com.whatsapp), v2.20.157 (453599)	WhatsApp Inc.	5,000,000,000
	Hangouts (com.google.android.talk), v33.0.303435107 (26266320)	Google LLC	1,000,000,000
	Messenger –Text and Video Chat for Free (com.facebook.orca), v263.1.0.35.125 (212938274)	Facebook	1,000,000,000
	Messages (com.google.android.apps.messaging), v5.9.099 (Wyvern_RC10,phone_dynamic) (59099000)	Google LLC	1,000,000,000
ACCESS_FINE_LOCATION			
	Google Chrome: Fast & Secure (Table Continues)	Google LLC	5,000,000,000

Table 90 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(com.android.chrome), v81.0.4044.138 (404413823)		
	WhatsApp Messenger	WhatsApp Inc.	5,000,000,000
	(com.whatsapp), v2.20.157 (453599)		
	Messenger –Text and Video Chat for Free	Facebook	1,000,000,000
	(com.facebook.orca), v263.1.0.35.125 (212938274)		
	Samsung Internet Browser	Samsung Electronics Co., Ltd.	1,000,000,000
	(com.sec.android.app.sbrowser), v11.2.1.3 (1112103502)		
	Messages	Google LLC	1,000,000,000
	(com.google.android.apps.messaging), v5.9.099 (Wyvern_RC10,phone_dynamic) (59099000)		
ACCESS_COARSE_LOCATION			
	Google Chrome: Fast & Secure	Google LLC	5,000,000,000
	(com.android.chrome), v81.0.4044.138 (404413823)		
	WhatsApp Messenger	WhatsApp Inc.	5,000,000,000
	(com.whatsapp), v2.20.157 (453599)		
	Messenger –Text and Video Chat for Free	Facebook	1,000,000,000
	(com.facebook.orca), v263.1.0.35.125 (212938274)		
	Samsung Internet Browser	Samsung Electronics Co., Ltd.	1,000,000,000
	(com.sec.android.app.sbrowser), v11.2.1.3 (1112103502)		
	Messages	Google LLC	1,000,000,000
	(com.google.android.apps.messaging), v5.9.099 (Wyvern_RC10,phone_dynamic) (59099000)		
WRITE_CONTACTS			
	Gmail	Google LLC	5,000,000,000
	(com.google.android.gm), v2020.04.12.307915656.Release (62161216)		
	WhatsApp Messenger	WhatsApp Inc.	5,000,000,000
	(com.whatsapp), v2.20.157 (453599)		
	Hangouts	Google LLC	1,000,000,000
	(com.google.android.talk), v33.0.303435107 (26266320)		
	Messenger –Text and Video Chat for Free	Facebook	1,000,000,000
	(com.facebook.orca), v263.1.0.35.125 (212938274)		
	Messages	Google LLC	1,000,000,000
	(com.google.android.apps.messaging), v5.9.099 (Wyvern_RC10,phone_dynamic) (59099000)		
READ_PHONE_STATE			
	WhatsApp Messenger	WhatsApp Inc.	5,000,000,000
	(com.whatsapp), v2.20.157 (453599)		
	Hangouts	Google LLC	1,000,000,000
	(com.google.android.talk), v33.0.303435107 (26266320)		
	Messenger –Text and Video Chat for Free	Facebook	1,000,000,000
	(com.facebook.orca), v263.1.0.35.125 (212938274)		

(Table Continues)

Table 90 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	Samsung Internet Browser (com.sec.android.app.sbrowser), v11.2.1.3 (1112103502)	Samsung Electronics Co., Ltd.	1,000,000,000
	Messages (com.google.android.apps.messaging), (Wyvern_RC10,phone_dynamic) (59099000) v5.9.099	Google LLC	1,000,000,000
CALL_PHONE			
	Gmail (com.google.android.gm), v2020.04.12.307915656.Release (62161216)	Google LLC	5,000,000,000
	Hangouts (com.google.android.talk), v33.0.303435107 (26266320)	Google LLC	1,000,000,000
	Messenger –Text and Video Chat for Free (com.facebook.orca), v263.1.0.35.125 (212938274)	Facebook	1,000,000,000
	Messages (com.google.android.apps.messaging), (Wyvern_RC10,phone_dynamic) (59099000) v5.9.099	Google LLC	1,000,000,000
	Skype - free IM & video calls (com.skype.raider), v8.59.0.77 (1250090458)	Skype	1,000,000,000
SEND_SMS			
	WhatsApp Messenger (com.whatsapp), v2.20.157 (453599)	WhatsApp Inc.	5,000,000,000
	Hangouts (com.google.android.talk), v33.0.303435107 (26266320)	Google LLC	1,000,000,000
	Messenger –Text and Video Chat for Free (com.facebook.orca), v263.1.0.35.125 (212938274)	Facebook	1,000,000,000
	Messages (com.google.android.apps.messaging), (Wyvern_RC10,phone_dynamic) (59099000) v5.9.099	Google LLC	1,000,000,000
	Truecaller: Caller ID, block robocalls & spam SMS (com.truecaller), v11.4.6 (1104006)	True Software Scandinavia AB	500,000,000
RECEIVE_SMS			
	WhatsApp Messenger (com.whatsapp), v2.20.157 (453599)	WhatsApp Inc.	5,000,000,000
	Hangouts (com.google.android.talk), v33.0.303435107 (26266320)	Google LLC	1,000,000,000
	Messenger –Text and Video Chat for Free (com.facebook.orca), v263.1.0.35.125 (212938274)	Facebook	1,000,000,000
	Messages (com.google.android.apps.messaging), (Wyvern_RC10,phone_dynamic) (59099000) v5.9.099	Google LLC	1,000,000,000
	Truecaller: Caller ID, block robocalls & spam SMS	True Software Scandinavia AB	500,000,000

(Table Continues)

Table 90 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(com.truecaller), v11.4.6 (1104006)		
READ_SMS			
	Hangouts (com.google.android.talk), v33.0.303435107 (26266320)	Google LLC	1,000,000,000
	Messenger –Text and Video Chat for Free (com.facebook.orca), v263.1.0.35.125 (212938274)	Facebook	1,000,000,000
	Messages (com.google.android.apps.messaging), v5.9.099 (Wyvern_RC10.phone_dynamic) (59099000)	Google LLC	1,000,000,000
	Truecaller: Caller ID, block robocalls & spam SMS (com.truecaller), v11.4.6 (1104006)	True Software Scandinavia AB	500,000,000
	KakaoTalk: Free Calls & Text (com.kakao.talk), v8.8.5 (1908851)	Kakao Corporation	100,000,000
RECEIVE_MMS			
	Hangouts (com.google.android.talk), v33.0.303435107 (26266320)	Google LLC	1,000,000,000
	Messenger –Text and Video Chat for Free (com.facebook.orca), v263.1.0.35.125 (212938274)	Facebook	1,000,000,000
	Messages (com.google.android.apps.messaging), v5.9.099 (Wyvern_RC10.phone_dynamic) (59099000)	Google LLC	1,000,000,000
	Truecaller: Caller ID, block robocalls & spam SMS (com.truecaller), v11.4.6 (1104006)	True Software Scandinavia AB	500,000,000
	KakaoTalk: Free Calls & Text (com.kakao.talk), v8.8.5 (1908851)	Kakao Corporation	100,000,000
READ_CALL_LOG			
	Viber Messenger - Messages, Group Chats & Calls (com.viber.voip), v12.9.5.2 (640529)	Viber Media S.à r.l.	500,000,000
	Telegram (org.telegram.messenger), v6.1.1 (19477)	Telegram FZ-LLC	500,000,000
	Truecaller: Caller ID, block robocalls & spam SMS (com.truecaller), v11.4.6 (1104006)	True Software Scandinavia AB	500,000,000
	CallApp: Caller ID, Call Blocker & Call Recorder (com.callapp.contacts), v1.620 (1620)	CallApp Caller ID, Manage & Customize your calls	50,000,000
	Call Free : Free Call & Free Text (call.free.international.phone.call), v1.7.5 (175)	Call Free, Caller ID, Call Recorder by Call Team	10,000,000
WRITE_CALENDAR			
	Gmail (com.google.android.gm), v2020.04.12.307915656.Release (62161216)	Google LLC	5,000,000,000
	KakaoTalk: Free Calls & Text (Table Continues)	Kakao Corporation	100,000,000

Table 90 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(com.kakao.talk), v8.8.5 (1908851)		
	CallApp: Caller ID, Call Blocker & Call Recorder (com.callapp.contacts), v1.620 (1620)	CallApp Caller ID, Manage & Customize your calls	50,000,000
	Signal Private Messenger (org.thoughtcrime.securesms), v4.59.9 (6292)	Signal Foundation	10,000,000
	Privacy Messenger - Private SMS messages, Call app (com.melonsapp.privacymessenger), v5.7.8 (624)	Melons Messenger Inc.	1,000,000
READ_CALENDAR			
	Gmail (com.google.android.gm), v2020.04.12.307915656.Release (62161216)	Google LLC	5,000,000,000
	KakaoTalk: Free Calls & Text (com.kakao.talk), v8.8.5 (1908851)	Kakao Corporation	100,000,000
	CallApp: Caller ID, Call Blocker & Call Recorder (com.callapp.contacts), v1.620 (1620)	CallApp Caller ID, Manage & Customize your calls	50,000,000
	Signal Private Messenger (org.thoughtcrime.securesms), v4.59.9 (6292)	Signal Foundation	10,000,000
	Privacy Messenger - Private SMS messages, Call app (com.melonsapp.privacymessenger), v5.7.8 (624)	Melons Messenger Inc.	1,000,000
PROCESS_OUTGOING_CALLS			
	Truecaller: Caller ID, block robocalls & spam SMS (com.truecaller), v11.4.6 (1104006)	True Software Scandinavia AB	500,000,000
	CallApp: Caller ID, Call Blocker & Call Recorder (com.callapp.contacts), v1.620 (1620)	CallApp Caller ID, Manage & Customize your calls	50,000,000
	Call Free : Free Call & Free Text (call.free.international.phone.call), v1.7.5 (175)	Call Free, Caller ID, Call Recorder by Call Team	10,000,000
	Phone + Contacts and Calls (v.d.d.answercall), v3.7.0 (37077)	FUG	10,000,000
	Mobile operators (com.glebzakaev.mobilecarriers), v2.22 (546)	Gleb Zakaev	1,000,000
WRITE_CALL_LOG			
	Google Duo - High Quality Video Calls (com.google.android.apps.tachyon), v91.0.315322534.DR91_RC03 (3014415)	Google LLC	1,000,000,000
	Truecaller: Caller ID, block robocalls & spam SMS (com.truecaller), v11.4.6 (1104006)	True Software Scandinavia AB	500,000,000
	CallApp: Caller ID, Call Blocker & Call Recorder (com.callapp.contacts), v1.620 (1620)	CallApp Caller ID, Manage & Customize your calls	50,000,000
	Call Free : Free Call & Free Text (call.free.international.phone.call), v1.7.5 (175)	Call Free, Caller ID, Call Recorder by Call Team	10,000,000
	Phone + Contacts and Calls	FUG	10,000,000

(Table Continues)

Table 90 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(v.d.d.answercall), v3.7.0 (37077)		
ANSWER_PHONE_CALLS			
	Truecaller: Caller ID, block robocalls & spam SMS (com.truecaller), v11.4.6 (1104006)	True Software Scandinavia AB	500,000,000
	Zalo - Video Call (com.zing.zalo), v20.04.02 (12100501)	Zalo Group	100,000,000
	Phone + Contacts and Calls (v.d.d.answercall), v3.7.0 (37077)	FUG	10,000,000
	Social Messenger: Free Mobile Calling, Live Chats (com.messagingnew.allinone), v8.0 (83)	CanAli	5,000,000
	Mobile operators (com.glebzakaev.mobilecarriers), v2.22 (546)	Gleb Zakaev	1,000,000
RECEIVE_WAP_PUSH			
	Messages (com.google.android.apps.messaging), (Wyvern_RC10,phone_dynamic) (59099000)	v5.9.099 Google LLC	1,000,000,000
	Textra SMS (com.textra), v4.25 (42590)	Delicious	10,000,000
	Messenger for SMS (com.link.messages.sms), v2.2.9 (229)	SMS Messenger	10,000,000
READ_PHONE_NUMBERS			
	imo free video calls and chat (com.imo.android.imoim), v2020.04.2041 (20042041)	imo.im	500,000,000
	imo beta free calls and text (com.imo.android.imoimbeta), v2020.05.1022 (20051022)	imo.im	100,000,000
BODY_SENSORS			
	WeChat (com.tencent.mm), v7.0.13 (1621)	WeChat	100,000,000
ACTIVITY_RECOGNITION			
	WeChat (com.tencent.mm), v7.0.13 (1621)	WeChat	100,000,000
ACCESS_MEDIA_LOCATION			
	Zalo - Video Call (com.zing.zalo), v20.04.02 (12100501)	Zalo Group	100,000,000
ACCESS_BACKGROUND_LOCATION			
	다음 - Daum (net.daum.android.daum), v6.9.13 (348)	Kakao Corp.	10,000,000

Table 91 lists the 5 most popular Communication apps that requested the most permissions, whereas Table 92 lists the 5 most popular Communication apps that requested the fewest permissions.

Top 5 Apps	Developer	# of Installs	Permissions
TextU - Private SMS Messenger, Call app (com.textu.sms.privacy.messenger), v4.2.8 (708)	Melons Chat Group	100,000	54
Samsung Internet Browser (com.sec.android.app.sbrowser), v11.2.1.3 (1112103502)	Samsung Electronics Co., Ltd.	1,000,000,000	52
Privacy Messenger - Private SMS messages, Call app (com.melonsapp.privacymessenger), v5.7.8 (624)	Melons Messenger Inc.	1,000,000	51
Truecaller: Caller ID, block robocalls & spam SMS (com.truecaller), v11.4.6 (1104006)	True Software Scandinavia AB	500,000,000	47
Signal Private Messenger (org.thoughtcrime.securesms), v4.59.9 (6292)	Signal Foundation	10,000,000	47

Table 91: The 5 most popular Communication apps that requested the most permissions.

Top 5 Apps	Developer	# of Installs	Permissions
Dolphin Tab Reload (mobi.mgeek.tabreload), v1.5.2 (8)	Dolphin Browser Add-ons □	100,000	1
Swarachakra Tamil Keyboard (iit.android.swarachakraTamil), v2.01 (20)	Swarachakra Team, IDC, IIT Bombay	1,000,000	2
Dolphin Tab Switcher (mobi.mgeek.tabswitcher), v2.0 (6)	Dolphin Browser Add-ons □	100,000	2
ScribMaster draw and paint (net.thoster.noteshare), v2018.2 (78)	Alstapp Note & Draw	500,000	4
Fastest Browser - Fast Download Private & Safe (com.ap.pacorporation.lifebrowse), v1.1 (2)	pacorporation	1,000	4

Table 92: The 5 most popular Communication apps that requested the least number of permissions.

D.3.2.2 Permission Usage While the previous subsection depicted the dangerous permissions *requested* by the apps that were tested, Table 93 lists the Communication apps based on the dangerous permissions that were observed being *used* during the testing period.

Table 93: Communication apps based on total number of permissions requested, the number of those that are considered “dangerous,” and the percentage of those dangerous permissions that were used during testing.

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
TextU - Private SMS Messenger, Call app (com.textu.sms.privacy.messenger), v4.2.8 (708)	Melons Chat Group	54	20	30.0
Samsung Internet Browser (com.sec.android.app.sbrowser), v11.2.1.3 (1112103502)	Samsung Electronics Co., Ltd.	52	8	12.5
Privacy Messenger - Private SMS messages, Call app (com.melonsapp.privacymessenger), v5.7.8 (624)	Melons Messenger Inc.	51	20	20.0
Truecaller: Caller ID, block robocalls & spam SMS (com.truecaller), v11.4.6 (1104006)	True Software Scandinavia AB	47	19	0.0
QQ (com.tencent.mobileqq), v8.2.9 (1353)	Tencent Technology (Shenzhen) Company Ltd.	47	9	0.0
Signal Private Messenger (org.thoughtcrime.securesms), v4.59.9 (6292)	Signal Foundation	47	17	5.9
WeChat (com.tencent.mm), v7.0.13 (1621)	WeChat	46	12	0.0
CallApp: Caller ID, Call Blocker & Call Recorder (com.callapp.contacts), v1.620 (1620)	CallApp Caller ID, Manage & Customize your calls	46	18	0.0
Viber Messenger - Messages, Group Chats & Calls (com.viber.voip), v12.9.5.2 (640529)	Viber Media S.à r.l.	46	12	16.7
Messenger for SMS (com.link.messages.sms), v2.2.9 (229)	SMS Messenger	46	16	25.0
Call Free : Free Call & Free Text (call.free.international.phone.call), v1.7.5 (175)	Call Free, Caller ID, Call Recorder by Call Team	42	10	0.0
UC Browser- Free & Fast Video Downloader, News App (com.UCMobile.intl), v13.1.2.1293 (50105)	UCWeb Singapore Pte. Ltd.	41	6	0.0
KakaoTalk: Free Calls & Text (com.kakao.talk), v8.8.5 (1908851)	Kakao Corporation	40	17	17.6
Messenger –Text and Video Chat for Free (com.facebook.orca), v263.1.0.35.125 (212938274)	Facebook	39	15	0.0
WhatsApp Messenger (com.whatsapp), v2.20.157 (453599)	WhatsApp Inc.	39	12	0.0
imo beta free calls and text	imo.im	39	12	8.3

(Table Continues)

Table 93 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(com.imo.android.imoimbeta), v2020.05.1022 (20051022)				
Handcent Next SMS (Best texting with MMS,stickers) (com.handcent.app.nextsms), v8.9.6.4 (40809609)	Handcent	39	14	21.4
Skype - free IM & video calls (com.skype.raider), v8.59.0.77 (1250090458)	Skype	38	11	0.0
Zalo - Video Call (com.zing.zalo), v20.04.02 (12100501)	Zalo Group	38	13	7.7
Phone + Contacts and Calls (v.d.d.answercall), v3.7.0 (37077)	FUG	37	14	28.6
WhatsApp Business (com.whatsapp.w4b), v2.20.49 (826)	WhatsApp Inc.	37	10	30.0
imo free video calls and chat (com.imo.android.imoim), v2020.04.2041 (20042041)	imo.im	35	12	8.3
Telegram (org.telegram.messenger), v6.1.1 (19477)	Telegram FZ-LLC	34	12	8.3
Gmail (com.google.android.gm), v2020.04.12.307915656.Release (62161216)	Google LLC	33	10	0.0
LINE: Free Calls & Messages (jp.naver.line.android), v10.6.2 (100620147)	LINE Corporation	33	11	0.0
Microsoft Edge (com.microsoft.emmx), v45.03.4.4955 (4955004)	Microsoft Corporation	30	9	0.0
Textra SMS (com.textra), v4.25 (42590)	Delicious	29	14	28.6
Hangouts (com.google.android.talk), v33.0.303435107 (26266320)	Google LLC	28	13	0.0
Naver Whale Browser (com.naver.whale), v1.4.3.2 (1055)	NAVER Corp.	28	8	0.0
Messages (com.google.android.apps.messaging), v5.9.099 (Wyvern_RC10,phone_dynamic) (59099000)	Google LLC	27	15	20.0
Firefox Browser: fast, private & safe web browser (org.mozilla.firefox), v68.8.0 (2015695963)	Mozilla	26	7	0.0
Ring - Always Home (com.ringapp), v3.25.0 (26452333)	Ring.com	25	9	11.1
Google Duo - High Quality Video Calls (com.google.android.apps.tachyon), v91.0.315322534.DR91_RC03 (3014415)	Google LLC	25	7	14.3
Messenger Lite: Free Calls & Messages	Facebook	24	7	0.0

(Table Continues)

Table 93 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(com.facebook.mlite), v86.0.1.3.126 (212855351)				
Google Chrome: Fast & Secure (com.android.chrome), v81.0.4044.138 (404413823)	Google LLC	23	7	0.0
Free Adblocker Browser - Adblock & Popup Blocker (com.hsv.freeadblockerbrowser), v72.0.2016123225 (2016123225)	Adblock - Rocketshield Browser Technology Limited	23	7	0.0
myMail -Email for Hotmail, Gmail and Outlook Mail (com.my.mail), v12.1.1.29709 (29709)	My.com B.V.	23	5	0.0
TypeApp mail - email app (com.trrf.blue), v1.9.7.32 (15857)	TypeApp LLC	23	7	0.0
Opera Mini - fast web browser (com.opera.mini.native), v47.2.2254.147957 (473147957)	Opera	22	7	0.0
GMX - Mail & Cloud (de.gmx.mobile.android.mail), v6.14.3 (404258)	GMX	22	6	0.0
Kiwi Browser - Fast & Quiet (com.kiwibrowser.browser), vQuadea (159)	Geometry OU	22	7	0.0
WEB.DE Mail & Cloud (de.web.mobile.android.mail), v6.14.3 (404256)	WEB.DE	22	6	0.0
mail.com mail (com.mail.mobile.android.mail), v6.14.3 (404252)	1&1 Mail & Media Inc	21	5	0.0
Ecosia - Trees & Privacy (com.ecosia.android), v3.7.8 (175)	Ecosia.org	21	7	0.0
Contacts (com.google.android.contacts), v3.22.4.309864854 (2390446)	Google LLC	20	6	0.0
Opera browser with free VPN (com.opera.browser), v57.2.2830.52651 (1905713603)	Opera	20	5	0.0
다음 - Daum (net.daum.android.daum), v6.9.13 (348)	Kakao Corp.	20	8	0.0
Email App for Any Mail (park.outlook.sign.in.client), v11.13.1.29164 (29164)	Craigpark Limited	20	5	20.0
Messenger : All-in-One Messaging & Video Calling (messengerchatapp.new17.update2017), v4.5 (27)	Halilov Mobiles by Oak pro	19	5	0.0
Yahoo Mail -Organized Email (com.yahoo.mobile.client.android.mail), v6.7.1 (1454180)	Yahoo	18	7	0.0
Connect for Hotmail & Outlook: Mail and Calendar (com.connectivityapps.hotmail), v5.3.5 (37)	Connectivity Apps	18	5	0.0
Social Messenger: Free Mobile Calling, Live Chats (com.messagingnew.allinone), v8.0 (83)	CanAli	18	8	0.0
Messenger SMS & MMS Share File Technologies	Share File Technologies	18	9	44.4

(Table Continues)

Table 93 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(sms.mms.messages.text.free), v17.0 (17)				
Firefox for Android Beta (org.mozilla.firefox_beta), v75.0.0-beta.6 (2015735819)	Mozilla	17	6	0.0
Discord - Friends, Communities, & Gaming (com.discord), v21.3 (1133)	Discord Inc.	17	5	0.0
Brave Private Browser: Fast, safe web browser (com.brave.browser), v1.8.93 (410809323)	Brave Software	17	6	0.0
Puffin Web Browser (com.cloudmosa.puffinFree), v8.3.0.41446 (10041446)	CloudMosa, Inc.	16	6	0.0
Mobile operators (com.glebzakaev.mobilecarriers), v2.22 (546)	Gleb Zakaev	15	9	44.4
Kik (kik.android), v15.22.0.22321 (30000549)	Kik Interactive	14	9	0.0
Email for Outlook & Hotmail: Fast, Easy & Secure (com.emailclient.mailchecker.outlook.hotmail), v1.17 (18)	HBSolution Inc.	14	5	20.0
Messenger app, Light All-in-One, Live Free Chat (comm.essagechat.listing), v17.0 (17)	Palinka Apps	13	4	0.0
Dolphin Jetpack - Fast & Flash (com.dolphin.browser.engine), v7.3.1 (210)	Dolphin Browser	12	4	25.0
Habit Browser (jp.ddo.pigsty.HabitBrowser), v1.1.77 (269)	mura.k	11	4	0.0
Firefox Focus: The privacy browser (org.mozilla.focus), v8.3.0 (341281936)	Mozilla	9	3	0.0
K-9 Mail (com.fsck.k9), v5.600 (26000)	K-9 Dog Walkers	9	3	0.0
Free VPN - VPN4Test (com.free.vpntest), v1.0.5 (14)	Ice Wall	7	0	0.0
PlayStation Messages - Check your online friends (com.playstation.mobilemessenger), v20.01.5.11295 (435)	PlayStation Mobile Inc.	7	3	0.0
Velocity Browser - Private Browser (com.hindbyte.velocity), v1.5.0 (50)	Hindbyte Group	7	4	0.0
Hear Boost: Enhanced Microphone Volume & Recording (com.audiofix.hearboost), v1.26 (26)	Future Moments	7	2	50.0
Screen Cut -Best Screenshot Capture & Crop app (mobi.mgeek.ScreenCut), v3.4 (23)	Dolphin Browser	6	1	100.0
ScribMaster draw and paint (net.thoster.noteshare), v2018.2 (78)	Alstapp Note & Draw	4	1	0.0
Fastest Browser - Fast Download Private & Safe (Table Continues)	pacorporation	4	1	0.0

Table 93 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(com.ap.pacorporation.litebrowse), v1.1 (2)	Swarachakra Team, IDC, IIT Bombay	2	0	0.0
Swarachakra Tamil Keyboard (iit.android.swarachakraTamil), v2.01 (20)	Swarachakra Team, IDC, IIT Bombay	2	0	0.0
Dolphin Tab Switcher (mobi.mgeek.tabswitcher), v2.0 (6)	Dolphin Browser Add-ons □	2	0	0.0
Dolphin Tab Reload (mobi.mgeek.tareload), v1.5.2 (8)	Dolphin Browser Add-ons □	1	0	0.0

D.3.3 Third-Party SDKs

We were able to identify 174 SDKs embedded within the 75 Communication apps. We list the 40 most common SDKs in Table 94,¹²² along with the number of Communication apps in which they were detected.

Table 94: The 40 most common SDKs identified within apps in the Communication category.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	66	(88.0%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	58	(77.3%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	39	(52.0%)
Google Ads	Google	Advertisement	34	(45.3%)
Google Gson	Google	Development Aid	33	(44.0%)
Glide	Bump Technologies	Development Aid	31	(41.3%)
ZXing ("Zebra Crossing")	ZXing Project	Development Aid	30	(40.0%)
Github	Github	Development Aid	27	(36.0%)
Google DoubleClick	Google	Advertisement	27	(36.0%)
Crashlytics	Google	Mobile Analytics	25	(33.3%)
Google Core Libraries for Java 6+	Google	Development Aid	25	(33.3%)
Facebook Ads	Facebook	Advertisement	22	(29.3%)
Google Play	Google Play	App Market	19	(25.3%)
Google Protocol Buffers	Google	Development Aid	18	(24.0%)
Apache Common	The Apache Software Foundation	Development Aid	17	(22.7%)

(Table Continues)

¹²²For an explanation of SDKs, see Section 4.1.2.

Table 94 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Analytics	Google	Mobile Analytics	17	(22.7%)
Fasterxml	FasterXML	Utility	16	(21.3%)
Facebook Login	Facebook	Digital Identity Advertisement Mobile Analytics	16	(21.3%)
Facebook Share	Facebook	Social Network Advertisement Mobile Analytics	16	(21.3%)
Google Internationalization	Google	Development Aid	14	(18.7%)
Jsoup	Jsoup	Development Aid	14	(18.7%)
MoPub	Twitter	Advertisement	13	(17.3%)
Apache Http	The Apache Software Founda- tion	Development Aid	13	(17.3%)
Facebook Analytics	Facebook	Mobile Analytics	13	(17.3%)
Flurry	Verizon	Mobile Analytics	13	(17.3%)
picasso	Square Inc.	Development Aid	12	(16.0%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	12	(16.0%)
getui	getui	Advertisement Mobile Analytics Push Notifications	10	(13.3%)
adjust	Adjust	Mobile Analytics Advertisement	10	(13.3%)
Volley HTTP library	Google	Development Aid Networking	9	(12.0%)
JavaX Annotation API	JavaX Annotation API	Utility	9	(12.0%)
SLF4J	SLF4J	Development Aid	9	(12.0%)
Facebook Places	Facebook	Map/LBS Advertisement	9	(12.0%)
Integral Ad Science	Integral Ad Science Inc.	Mobile Analytics Advertisement	8	(10.7%)

(Table Continues)

Table 94 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
		AdFraud		
Moat	Oracle	Mobile Analytics	8	(10.7%)
Spongy Castle	Spongy Castle	Development Aid	8	(10.7%)
Google Tag Manager	Google	Mobile Analytics	8	(10.7%)
Nine Old Androids	Nine Old Androids	Development Aid	7	(9.3%)
Bouncy Castle	Bouncy Castles	Development Aid	7	(9.3%)
Amazon Advertisement	Amazon	Advertisement	7	(9.3%)

Several of these SDKs included developer tools, which we characterize as SDKs that provide tools and functionality to app developers which are unlikely to be used for the transmission of user information. As a result, we separately present Table 95, which depicts the 40 most common SDKs with developer tools removed, along with the number of Communication apps in which they were detected.

Table 95: The 40 most common SDKs identified within apps in the Communication category, with developer tools removed.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	66	(88.0%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	58	(77.3%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	39	(52.0%)
Google Ads	Google	Advertisement	34	(45.3%)

(Table Continues)

Table 95 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google DoubleClick	Google	Advertisement	27	(36.0%)
Crashlytics	Google	Mobile Analytics	25	(33.3%)
Facebook Ads	Facebook	Advertisement	22	(29.3%)
Google Play	Google Play	App Market	19	(25.3%)
Google Analytics	Google	Mobile Analytics	17	(22.7%)
Facebook Login	Facebook	Digital Identity Advertisement Mobile Analytics	16	(21.3%)
Facebook Share	Facebook	Social Network Advertisement Mobile Analytics	16	(21.3%)
MoPub	Twitter	Advertisement	13	(17.3%)
Facebook Analytics	Facebook	Mobile Analytics	13	(17.3%)
Flurry	Verizon	Mobile Analytics	13	(17.3%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	12	(16.0%)
getui	getui	Advertisement Mobile Analytics Push Notifications	10	(13.3%)
adjust	Adjust	Mobile Analytics Advertisement	10	(13.3%)
Volley HTTP library	Google	Development Aid Networking	9	(12.0%)
Facebook Places	Facebook	Map/LBS Advertisement	9	(12.0%)
Integral Ad Science	Integral Ad Science Inc.	Mobile Analytics Advertisement AdFraud	8	(10.7%)
Moat	Oracle	Mobile Analytics	8	(10.7%)
Google Tag Manager	Google	Mobile Analytics	8	(10.7%)
Amazon Advertisement	Amazon	Advertisement	7	(9.3%)

(Table Continues)

Table 95 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Tencent Wechat	Tencent	Social Network	6	(8.0%)
Microsoft Appcenter Crashes	Microsoft	Mobile Analytics	6	(8.0%)
myTarget	My.com	Advertisement Social Networking	5	(6.7%)
HockeyApp	Microsoft	Mobile Analytics	5	(6.7%)
Tencent Login	Tencent	Social Network	4	(5.3%)
Microsoft Appcenter Analytics	Microsoft	Mobile Analytics	4	(5.3%)
LeanPlum	Leanplum	Mobile Analytics	4	(5.3%)
Smaato	Smaato	Advertisement LBS	4	(5.3%)
AppMonet	Monet Engine Inc.	Advertisement	4	(5.3%)
INFOline	InfOnline	Mobile Analytics	3	(4.0%)
QihooPP Framework	Qihoo 360	Development Framework Mobile Analytics Cybersecurity	3	(4.0%)
AppMetrica	Yandex	Mobile Analytics	3	(4.0%)
Yandex Ad	Yandex	Advertisement	3	(4.0%)
Mintegral	Mobvista	Advertisement	3	(4.0%)
Fyber	Fyber	Advertisement	3	(4.0%)
OneSignal	OneSignal	Mobile Analytics	3	(4.0%)
Unity3D	Unity Technologies	Game Engine Mobile Analytics Advertisement	3	(4.0%)

D.4 News & Magazines Apps

D.4.1 Data Types Transmitted

Apps in the News & Magazines category were observed transmitting the data types listed in Table 96 during the testing period.¹²³

Data Type	# of Apps	(% of Apps)
AAID	52	(78.8%)
Android ID	30	(45.5%)
Coarse Location	12	(18.2%)
GPS Location	11	(16.7%)
Email	3	(4.5%)
Name	3	(4.5%)
WiFi SSID	2	(3.0%)
IMEI	2	(3.0%)
BT Name	1	(1.5%)
WiFi MAC	1	(1.5%)
GSF ID	1	(1.5%)
IMSI	1	(1.5%)
WiFi BSSID	1	(1.5%)
SIM ID	1	(1.5%)
Serial #	1	(1.5%)

Table 96: Data types transmitted by apps in the News & Magazines category during the testing period.

¹²³For an explanation of these data types, see Section 3.

D.4.1.1 Most Common Hostnames Contacted

Table 97 depicts the top 10 hostnames observed being contacted by News & Magazines apps during the testing period, whereas Table 98 depicts the top 10 parent companies corresponding to these hostnames. This data reflects Internet servers that were *contacted* by apps, but does not necessarily mean that they received sensitive user information—we specifically discuss that subset of recipients in Section D.4.1.2.¹²⁴ The discrepancy between the two sections is due to the fact that some app transmissions may simply not contain sensitive user information or that its transmission was obfuscated using a method that we did not immediately recognize.

Hostname	Parent Company	# of Apps	(% of Apps)
settings.crashlytics.com	Google	43	(65.2%)
googleads.g.doubleclick.net	Google	30	(45.5%)
graph.facebook.com	Facebook	29	(43.9%)
firebaseremoteconfig.googleapis.com	Google	22	(33.3%)
pagead2.googleadservices.com	Google	21	(31.8%)
pubads.g.doubleclick.net	Google	16	(24.2%)
tpc.googlesyndication.com	Google	15	(22.7%)
firebaseinstallations.googleapis.com	Google	14	(21.2%)
www.googletagservices.com	Google	13	(19.7%)
cdn.liftoff.io	Liftoff	12	(18.2%)

Table 97: The top 10 most common hostnames contacted by News & Magazines apps during testing.

Company	# of Apps	(% of Apps)
Google	60	(90.9%)
Facebook	30	(45.5%)
Twitter	14	(21.2%)
Liftoff	12	(18.2%)
Verizon	10	(15.2%)
Nielsen	9	(13.6%)
AppsFlyer	9	(13.6%)
Adobe	8	(12.1%)
Reddit	8	(12.1%)
comScore	7	(10.6%)

¹²⁴We define “user information” in Section 3.

Company	# of Apps	(% of Apps)
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Table 98: The top 10 most common companies contacted by News & Magazines apps during testing.

D.4.1.2 Most Common Data Recipients

Table 99 depicts the top 10 data recipients among the News & Magazines apps during the testing period. Table 100 lists additional information about the most common data recipients, such as the approximate locations of their servers, IP addresses contacted during testing, and the types of sensitive user information that we observed them receive during the testing period.

Hostname	Parent Company	# of Apps	(% of Apps)
graph.facebook.com	Facebook	28	(42.4%)
ads.mopub.com	Twitter	11	(16.7%)
www.facebook.com	Facebook	10	(15.2%)
secure-dcr.imrworldwide.com	Nielsen	9	(13.6%)
settings.crashlytics.com	Google	9	(13.6%)
data.flurry.com	Verizon	8	(12.1%)
impression-east.liftoff.io	Liftoff	6	(9.1%)
mpx.mopub.com	Twitter	6	(9.1%)
s.amazon-adsystem.com	Amazon	5	(7.6%)
tr-asia.adsmoloco.com	Moloco	5	(7.6%)

Table 99: The top 10 most common data recipients from News & Magazines apps during testing.

Table 100: The 10 most common recipient hostnames of user information from News apps during the testing period, along with their IP addresses, company information, and the data types that were observed being transmitted.

Parent Company	Country	IPs	Received Data
graph.facebook.com			
Facebook	United States	157.240.8.18 (US)	Android ID AAID
ads.mopub.com			
Twitter	United States	192.48.236.11 (US) 192.48.236.12 (US) 192.48.236.9 (US)	BT Name GPS Location AAID Coarse Location
www.facebook.com			
Facebook	United States	157.240.8.35 (US)	BT Name AAID
settings.crashlytics.com			
Google	United States	172.217.167.99 (US) 142.250.66.163 (US) 216.58.203.99 (US) 142.250.67.3 (US) 142.250.66.195 (US)	BT Name Android ID AAID
secure-dcr.imrworldwide.com			
Nielsen	United States	52.64.157.155 (AU) 52.65.116.110 (AU) 3.104.88.102 (AU) 52.64.49.109 (AU) 3.104.133.38 (AU) 13.238.227.46 (AU)	AAID
data.flurry.com			
Verizon	United States	115.178.9.19 (HK) 115.178.9.18 (HK)	Android ID AAID IMEI
mpx.mopub.com			
(Table Continues)			

Table 100 (Continued)

Parent Company	Country	IPs	Received Data
Twitter	United States	192.48.236.11 (US) 192.48.236.12 (US) 192.48.236.9 (US)	GPS Location Coarse Location AAID
impression-east.liftoff.io			
Liftoff	United States	18.233.123.55 (US)	AAID
s.amazon-adsystem.com			
Amazon	United States	52.94.232.32 (US) 52.46.130.13 (US)	AAID
tr-asia.adsmoloco.com			
Moloco	United States	107.178.244.18 (US)	AAID

D.4.1.3 Apps Ranked by Number of Recipients

Table 101 ranks the News & Magazines apps based on the number of recipients to which we detected each transmit sensitive user information during testing.

Table 101: News & Magazines apps ordered by the number of recipients (by unique hostnames and their parent companies) during the testing period.

App	Developer	Installs	Recipients	
			Hostnames	Companies
CNN Breaking US & World News Package Name: com.cnn.mobile.android.phone Version: 6.9 (30199)	CNN	10,000,000	17	14
BaconReader for Reddit Package Name: com.onelouder.baconreader Version: 5.7.0 (123)	OneLouder Apps	1,000,000	13	10
Podcast Player Package Name: com.podcast.podcasts Version: 6.2.2-200407051.raa85500 (200407051)	Castbox.FM - Radio & Podcast & AudioBooks	10,000,000	18	9
Daily Mail Online Package Name: com.dailymail.online Version: 5.2.14 (186)	Daily Mail Online	5,000,000	13	9
Hindi News:Live India News, Live TV, Newspaper App Package Name: com.nbt.reader Version: 4.2.2.0 (4220)	Times Internet Limited	5,000,000	15	9
Apple Daily 苹果新闻 Package Name: com.nextmedia Version: 5.4.0 (5404)	Next Mobile Limited	5,000,000	12	7
Stuff.co.nz Package Name: nz.co.stuff.android.news Version: 3.33.1 (946)	Stuff Limited	500,000	8	7
新浪新闻 Package Name: com.sina.news Version: 7.24.7 (437)	Sina.com	100,000	15	7
News by The Times of India Newspaper - Latest News Package Name: com.toi.reader.activities Version: 5.7.9.2 (5792)	Times Internet Limited	10,000,000	10	6
9NEWS Package Name: nineNewsAlerts.nine.com Version: 2.12.0 (105)	NINE NETWORK AUSTRALIA PTY LTD	100,000	7	6
Ukrainian news AllNews Package Name: gregory.network.rss Version: 3.1.92 (128)	ToEventWithFriends.com	100,000	11	6

(Table Continues)

Table 101 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
News Republic - Breaking and Trending News Package Name: com.mobilesrepublic.appy Version: 12.6.7.02 (12670002)	News Republic	50,000,000	14	5
News Suite by Sony Package Name: com.sony.nfx.app.sfrs Version: 5.2.10.30.1 (16521030)	Sony Network Communications Inc.	50,000,000	9	5
TopBuzz News: Breaking, Local, Entertaining & FREE Package Name: com.ss.android.article.master Version: 10.1.7.02 (101702)	TopBuzz	10,000,000	14	5
SmartNews: Local Breaking News Package Name: jp.gocro.smartnews.android Version: 7.7.0 (410)	SmartNews, Inc.	10,000,000	7	5
Sync for reddit Package Name: com.laurencedawson.reddit_sync Version: 19.0.3 (866)	Red Apps LTD	1,000,000	8	5
Quora —Ask Questions, Get Answers Package Name: com.quora.android Version: 2.8.52 (2045)	Quora, Inc.	10,000,000	4	4
rif is fun for Reddit Package Name: com.andrewshu.android.reddit Version: 4.16.12 (2512)	TalkLittle	5,000,000	5	4
BaBe+ - Berita Indonesia Package Name: com.ss.android.article.master.id Version: 10.6.2.02 (106202)	Mainspring	5,000,000	16	4
ABC NEWS Package Name: android.AbcApplication Version: 6.6.2 (4787)	Australian Broadcasting Corporation	1,000,000	4	4
News Home: Breaking News, Local & World News Today Package Name: com.home.news.breaking Version: 2.8.5-news-home (2000805)	My Home Apps	1,000,000	5	4
The Age Package Name: com.fairfaxmedia.ink.metro.age Version: 2.1.0 (4446)	Fairfax Media	10,000	6	4
Podcast Player & Podcast App - Castbox Package Name: fm.castbox.audiobook.radio.podcast Version: 8.13.2-200509141 (200509141)	Castbox.FM - Radio & Podcast & AudioBooks	10,000,000	3	3
Podcast App: Free & Offline Podcasts by Player FM Package Name: fm.player Version: 4.12.0.239 (17261)	Player FM Podcasts	5,000,000	3	3
News18 Latest & Breaking News Package Name: com.divum.ibn	Network18	5,000,000	4	3

(Table Continues)

Table 101 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Version: 7.5 (75) VnExpress.net Package Name: fr.playsoft.vnexpress Version: 7.8.5 (228)	VnExpress.net	1,000,000	5	3
France Press Package Name: com.lagoo.paris Version: 2.2 (20200)	Studio BabDreams	100,000	3	3
Herald Sun Package Name: com.newscorp.heraldsun Version: 7.25.0 (171)	NDM	50,000	3	3
The Sydney Morning Herald Package Name: com.fairfaxmedia.ink.metro.smh Version: 2.1.0 (4446)	Fairfax Media	10,000	4	3
The Courier-Mail Package Name: com.newscorp.couriermail Version: 7.25.0 (171)	NDM	10,000	3	3
Ready For Reddit - Material 2.0 Package Name: com.devgary.ready Version: 2.5.0 (84)	Gary Wong	10,000	5	3
Reddit Package Name: com.reddit.frontpage Version: 2020.17.0 (267902)	reddit Inc.	10,000,000	3	2
Podcast Addict Package Name: com.bambuna.podcastaddict Version: 2020.7.1 (20154)	Xavier Guillemene - Podcast & Radio Addict	5,000,000	2	2
DER SPIEGEL Package Name: de.spiegel.android.app.spon Version: 4.1.0 (160)	DER SPIEGEL GmbH & Co. KG	5,000,000	3	2
Podcast App & Podcast Player - Podbean Package Name: com.podbean.app.podcast Version: 7.6.1 (761)	Podbean - Podcast & Radio & Audiobook	1,000,000	3	2
EL PAÍS Package Name: com.elpais.elpais Version: 2.10.0 (441)	El País	1,000,000	2	2
Bangla Newspaper –Prothom Alo Package Name: com.mcc.prothomalo Version: 8.7 (100016)	Prothom Alo	1,000,000	2	2
Boost for reddit Package Name: com.rubenmayayo.reddit Version: 1.10.0 (143)	Rubén Mayayo	500,000	3	2
Relay for reddit	DBrady (Table Continues)	500,000	3	2

Table 101 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Package Name: free.reddit.news Version: 10.0.138 (464)				
FM Córdoba Package Name: ar.com.cadena3.fmcordoba Version: 3.1.140 (24)	Cadena 3 Argentina	100,000	2	2
manager-magazin.de Package Name: de.spiegel.android.app.mmo Version: 1.4.12 (112)	manager magazin Verlagsgesellschaft mbH	50,000	3	2
news.com.au Package Name: com.newscorp.newscomau.app Version: 1.5.3 (25)	NDM	50,000	2	2
The Advertiser Package Name: com.newscorp.adelaideadvertiser Version: 7.25.0 (171)	NDM	10,000	2	2
Twitter Package Name: com.twitter.android Version: 8.43.0-release.00 (18430000)	Twitter, Inc.	500,000,000	2	1
BBC News Package Name: bbc.mobile.news.ww Version: 5.12.0 (111155)	BBC Worldwide (Ltd)	10,000,000	1	1
The Guardian - Live World News, Sport & Opinion Package Name: com.guardian Version: 6.41.2312 (2312)	Guardian News & Media Ltd	5,000,000	1	1
20 Minuten (CH) Package Name: ch.iAgentur.i20Min Version: 20.0.7.1 (18823)	20 Minuten	1,000,000	1	1
Australia Breaking News & Local News For Free Package Name: ma.safe.bnau Version: 10.5.1 (100501)	Safe Apps Inc	100,000	1	1
Nairaland Forum Package Name: com.compass.nairaland Version: 1.4 (27)	Softrealm Solutions	100,000	1	1
Good News Network Package Name: com.ml.goodnewsnetwork Version: 2.5 (20200507)	Geri Weis-Corbley	50,000	1	1
T24 Package Name: com.opera.t24 Version: 2.1.1 (19)	T24 Bağımsız internet gazetesi	50,000	1	1
Feedly Classic Package Name: com.devhd.feedly.classic Version: 39.0.1-classic (701)	Feedly Team	10,000	1	1

(Table Continues)

Table 101 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Polish Newspapers Package Name: com.tachanfil.polskiegazety Version: 5.0.5 (505)	MUNBEN	10,000	1	1
Thailand News in English Package Name: com.thailand.news.english Version: 1.0 (12)	Appachi	5,000	1	1
Google News: Top World & Local News Headlines Package Name: com.google.android.apps.magazines Version: 5.21.1.20032110 (2020032110)	Google LLC	1,000,000,000	0	0
Feedly - Smarter News Reader Package Name: com.devhd.feedly Version: 75.0.0 (790)	Feedly Team	5,000,000	0	0
Pocket Casts - Podcast Player Package Name: au.com.shiftyjelly.pocketcasts Version: 7.8.3 (5436)	Podcast Media LLC	1,000,000	0	0
Podcast Republic - Podcast Player & Radio App Package Name: com.itunestoppodcastplayer.app Version: 20.5.11R (210995)	Podcast Republic	1,000,000	0	0
Le Point : actualités et journal d'informations Package Name: fr.lepoint.android Version: 8.1.2 (8010206)	Le Point	1,000,000	0	0
VicEmergency Package Name: com.naturallybeing.fireready Version: 6.2.3 (602030)	Department of Justice & Community Safety, Victoria	500,000	0	0
Son Dakika Haberleri Package Name: appstoxe.habersondakika Version: 3.54 (35400000)	Appstoxe Uygulama Merkezi	500,000	0	0
Joey for Reddit Package Name: o.o.joey Version: 1.8.6.2 (294)	CodesForLiving	100,000	0	0
Palabre Feedly RSS Reader News Package Name: com.levelup.palabre Version: 3.2.4 (3020400)	LevelUp Studio	100,000	0	0
ANI News Package Name: com.ani.news Version: 3.2 (302)	ANI News	100,000	0	0
今日澳洲 - 新移民留房招聘一手掌握 Package Name: au.com.nexty.today Version: 3.24.1 (2020042702)	Media Today Group Pty Ltd	100,000	0	0
Dnevnik.hr Package Name: com.cme.newsreader.dnevnik.hr	Nova TV d.d.	100,000	0	0

(Table Continues)

Table 101 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Version: 1.3 (19)				

D.4.1.4 Popular Apps Transmitting Each Data Type

For each of these data types, Table 102 lists the top 5 most popular News & Magazines apps that we observed transmitting them during testing.¹²⁵

Table 102: The top 5 News & Magazines apps that we detected transmitting each data type during the testing period.

Data Type	Top 5 Apps	Developer	# of Installs
AAID	Twitter (com.twitter.android), v8.43.0-release.00 (18430000)	Twitter, Inc.	500,000,000
	News Republic - Breaking and Trending News (com.mobilesrepublic.appy), v12.6.7.02 (12670002)	News Republic	50,000,000
	News Suite by Sony (com.sony.nfx.app.sfr), v5.2.10.30.1 (16521030)	Sony Network Communications Inc.	50,000,000
	Quora —Ask Questions, Get Answers (com.quora.android), v2.8.52 (2045)	Quora, Inc.	10,000,000
	Reddit (com.reddit.frontpage), v2020.17.0 (267902)	reddit Inc.	10,000,000
Android ID	Twitter (com.twitter.android), v8.43.0-release.00 (18430000)	Twitter, Inc.	500,000,000
	News Republic - Breaking and Trending News (com.mobilesrepublic.appy), v12.6.7.02 (12670002)	News Republic	50,000,000
	Quora —Ask Questions, Get Answers (com.quora.android), v2.8.52 (2045)	Quora, Inc.	10,000,000
	Reddit (com.reddit.frontpage), v2020.17.0 (267902)	reddit Inc.	10,000,000
	Podcast Player & Podcast App - Castbox (fm.castbox.audiobook.radio.podcast), v8.13.2-200509141 (200509141)	Castbox.FM - Radio & Podcast & AudioBooks	10,000,000
Coarse Location	TopBuzz News: Breaking, Local, Entertaining & FREE (com.ss.android.article.master), v10.1.7.02 (101702)	TopBuzz	10,000,000
	SmartNews: Local Breaking News (jp.gocro.smartnews.android), v7.7.0 (410)	SmartNews, Inc.	10,000,000
	Daily Mail Online (com.dailymail.online), v5.2.14 (186)	Daily Mail Online	5,000,000
	Apple Daily 果動新聞 (com.nextmedia), v5.4.0 (5404)	Next Mobile Limited	5,000,000
	News Home: Breaking News, Local & World News Today (Table Continues)	My Home Apps	1,000,000

¹²⁵Popularity is determined by the number of reported installs in the Google Play Store.

Table 102 (Continued)

Data Type	Top 5 Apps	Developer	# of Installs
	(com.home.news.breaking), v2.8.5-news-home (2000805)		
GPS Location	TopBuzz News: Breaking, Local, Entertaining & FREE (com.ss.android.article.master), v10.1.7.02 (101702)	TopBuzz	10,000,000
	SmartNews: Local Breaking News (jp.gocro.smartnews.android), v7.7.0 (410)	SmartNews, Inc.	10,000,000
	Daily Mail Online (com.dailymail.online), v5.2.14 (186)	Daily Mail Online	5,000,000
	Apple Daily 果動新聞 (com.nextmedia), v5.4.0 (5404)	Next Mobile Limited	5,000,000
	News Home: Breaking News, Local & World News Today (com.home.news.breaking), v2.8.5-news-home (2000805)	My Home Apps	1,000,000
Email	Podcast Player & Podcast App - Castbox (fm.castbox.audiobook.radio.podcast), v8.13.2-200509141 (200509141)	Castbox.FM - Radio & Podcast & AudioBooks	10,000,000
	Podcast App & Podcast Player - Podbean (com.podbean.app.podcast), v7.6.1 (761)	Podbean - Podcast & Radio & Audiobook	1,000,000
	The Age (com.fairfaxmedia.ink.metro.age), v2.1.0 (4446)	Fairfax Media	10,000
Name	Podcast Player & Podcast App - Castbox (fm.castbox.audiobook.radio.podcast), v8.13.2-200509141 (200509141)	Castbox.FM - Radio & Podcast & AudioBooks	10,000,000
	Podcast App & Podcast Player - Podbean (com.podbean.app.podcast), v7.6.1 (761)	Podbean - Podcast & Radio & Audiobook	1,000,000
	The Age (com.fairfaxmedia.ink.metro.age), v2.1.0 (4446)	Fairfax Media	10,000
WiFi SSID	CNN Breaking US & World News (com.cnn.mobile.android.phone), v6.9 (30199)	CNN	10,000,000
	新浪新聞 (com.sina.news), v7.24.7 (437)	Sina.com	100,000
IMEI	Ukrainian news AllNews (gregory.network.rss), v3.1.92 (128)	ToEventWithFriends.com	100,000
	新浪新聞 (com.sina.news), v7.24.7 (437)	Sina.com	100,000
BT Name			

(Table Continues)

Table 102 (Continued)

Data Type	Top 5 Apps	Developer	# of Installs
	Podcast Player (com.podcast.podcasts), (200407051)	v6.2.2-200407051.raa85500 Castbox.FM - Radio & Podcast & AudioBooks	10,000,000
WiFi MAC	新浪新闻 (com.sina.news), v7.24.7 (437)	Sina.com	100,000
GSF ID	新浪新闻 (com.sina.news), v7.24.7 (437)	Sina.com	100,000
IMSI	新浪新闻 (com.sina.news), v7.24.7 (437)	Sina.com	100,000
WiFi BSSID	新浪新闻 (com.sina.news), v7.24.7 (437)	Sina.com	100,000
SIM ID	新浪新闻 (com.sina.news), v7.24.7 (437)	Sina.com	100,000
Serial #	新浪新闻 (com.sina.news), v7.24.7 (437)	Sina.com	100,000

Table 103 lists the 5 most popular News & Magazines apps that transmitted the most data types during the testing period, whereas Table 104 lists the 5 most popular News & Magazines apps that transmitted the fewest data types during the testing period.

Top 5 Apps	Developer	# of Installs	Data Types
新浪新闻 (com.sina.news), v7.24.7 (437)	Sina.com	100,000	11
Podcast Player & Podcast App - Castbox (fm.castbox.audiobook.radio.podcast), v8.13.2-200509141 (200509141)	Castbox.FM - Radio & Podcast & AudioBooks	10,000,000	4
TopBuzz News: Breaking, Local, Entertaining & FREE (com.ss.android.article.master), v10.1.7.02 (101702)	TopBuzz	10,000,000	4
Daily Mail Online (com.dailymail.online), v5.2.14 (186)	Daily Mail Online	5,000,000	4
Apple Daily 苹果新闻 (com.nextmedia), v5.4.0 (5404)	Next Mobile Limited	5,000,000	4

Table 103: The top 5 News & Magazines apps that transmitted the most data types during testing.

Top 5 Apps	Developer	# of Installs	Data Types
Google News: Top World & Local News Headlines (com.google.android.apps.magazines), v5.21.1.20032110 (2020032110)	Google LLC	1,000,000,000	0
Feedly - Smarter News Reader (com.devhd.feedly), v75.0.0 (790)	Feedly Team	5,000,000	0
Pocket Casts - Podcast Player (au.com.shiftyjelly.pocketcasts), v7.8.3 (5436)	Podcast Media LLC	1,000,000	0
Podcast Republic - Podcast Player & Radio App (com.itunestoppodcastplayer.app), v20.5.11R (210995)	Podcast Republic	1,000,000	0
Le Point : actualités et journal d'informations (fr.lepoint.android), v8.1.2 (8010206)	Le Point	1,000,000	0

Table 104: The top 5 News & Magazines apps that transmitted the fewest data types during testing.

D.4.2 App Permissions

Apps in the News & Magazines category requested the dangerous permissions listed in Table 105.¹²⁶

Data Type	# of Apps	(% of Apps)
WRITE_EXTERNAL_STORAGE	54	(81.8%)
READ_EXTERNAL_STORAGE	35	(53.0%)
ACCESS_COARSE_LOCATION	26	(39.4%)
ACCESS_FINE_LOCATION	23	(34.8%)
GET_ACCOUNTS	17	(25.8%)
READ_PHONE_STATE	14	(21.2%)
CAMERA	11	(16.7%)
RECORD_AUDIO	10	(15.2%)
CALL_PHONE	4	(6.1%)
WRITE_CALENDAR	1	(1.5%)
READ_CALENDAR	1	(1.5%)
WRITE_CONTACTS	1	(1.5%)
READ_CONTACTS	1	(1.5%)

Table 105: Dangerous permissions requested by apps in the News & Magazines category.

¹²⁶For an explanation of dangerous permissions, see Section 4.3.

D.4.2.1 Popular Apps Requesting Dangerous Permissions For each of these permissions, Table 106 lists the top 5 most popular apps that we observed requesting dangerous permissions during testing.¹²⁷

Table 106: The 5 most popular News & Magazines apps that requested each dangerous permission.

Permission	Top 5 Apps	Developer	# of Installs
WRITE_EXTERNAL_STORAGE	Google News: Top World & Local News Headlines (com.google.android.apps.magazines), v5.21.1.20032110 (2020032110)	Google LLC	1,000,000,000
	News Republic - Breaking and Trending News (com.mobilesrepublic.appy), v12.6.7.02 (12670002)	News Republic	50,000,000
	Quora —Ask Questions, Get Answers (com.quora.android), v2.8.52 (2045)	Quora, Inc.	10,000,000
	Reddit (com.reddit.frontpage), v2020.17.0 (267902)	reddit Inc.	10,000,000
	Podcast Player & Podcast App - Castbox (fm.castbox.audiobook.radio.podcast), v8.13.2-200509141 (200509141)	Castbox.FM - Radio & Podcast & AudioBooks	10,000,000
READ_EXTERNAL_STORAGE	News Republic - Breaking and Trending News (com.mobilesrepublic.appy), v12.6.7.02 (12670002)	News Republic	50,000,000
	Reddit (com.reddit.frontpage), v2020.17.0 (267902)	reddit Inc.	10,000,000
	Podcast Player & Podcast App - Castbox (fm.castbox.audiobook.radio.podcast), v8.13.2-200509141 (200509141)	Castbox.FM - Radio & Podcast & AudioBooks	10,000,000
	Podcast Player (com.podcast.podcasts), v6.2.2-200407051.raa85500 (200407051)	Castbox.FM - Radio & Podcast & AudioBooks	10,000,000
	CNN Breaking US & World News (com.cnn.mobile.android.phone), v6.9 (30199)	CNN	10,000,000
ACCESS_COARSE_LOCATION	Reddit (com.reddit.frontpage), v2020.17.0 (267902)	reddit Inc.	10,000,000
	Podcast Player & Podcast App - Castbox (fm.castbox.audiobook.radio.podcast), v8.13.2-200509141 (200509141)	Castbox.FM - Radio & Podcast & AudioBooks	10,000,000
	Podcast Player (com.podcast.podcasts), v6.2.2-200407051.raa85500 (200407051)	Castbox.FM - Radio & Podcast & AudioBooks	10,000,000

(Table Continues)

¹²⁷Popularity is determined by the number of reported installs in the Google Play Store.

Table 106 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	TopBuzz News: Breaking, Local, Entertaining & FREE (com.ss.android.article.master), v10.1.7.02 (101702)	TopBuzz	10,000,000
	SmartNews: Local Breaking News (jp.gocro.smartnews.android), v7.7.0 (410)	SmartNews, Inc.	10,000,000
ACCESS_FINE_LOCATION			
	Podcast Player & Podcast App - Castbox (fm.castbox.audiobook.radio.podcast), v8.13.2-200509141 (200509141)	Castbox.FM - Radio & Podcast & AudioBooks	10,000,000
	TopBuzz News: Breaking, Local, Entertaining & FREE (com.ss.android.article.master), v10.1.7.02 (101702)	TopBuzz	10,000,000
	SmartNews: Local Breaking News (jp.gocro.smartnews.android), v7.7.0 (410)	SmartNews, Inc.	10,000,000
	News by The Times of India Newspaper - Latest News (com.toi.reader.activities), v5.7.9.2 (5792)	Times Internet Limited	10,000,000
	Daily Mail Online (com.dailymail.online), v5.2.14 (186)	Daily Mail Online	5,000,000
GET_ACCOUNTS			
	Google News: Top World & Local News Headlines (com.google.android.apps.magazines), v5.21.1.20032110 (2020032110)	Google LLC	1,000,000,000
	Quora — Ask Questions, Get Answers (com.quora.android), v2.8.52 (2045)	Quora, Inc.	10,000,000
	Reddit (com.reddit.frontpage), v2020.17.0 (267902)	reddit Inc.	10,000,000
	BBC News (bbc.mobile.news.ww), v5.12.0 (111155)	BBC Worldwide (Ltd)	10,000,000
	Daily Mail Online (com.dailymail.online), v5.2.14 (186)	Daily Mail Online	5,000,000
READ_PHONE_STATE			
	Podcast Player & Podcast App - Castbox (fm.castbox.audiobook.radio.podcast), v8.13.2-200509141 (200509141)	Castbox.FM - Radio & Podcast & AudioBooks	10,000,000
	Podcast Player (com.podcast.podcasts), v6.2.2-200407051.raa85500 (200407051)	Castbox.FM - Radio & Podcast & AudioBooks	10,000,000
	Daily Mail Online (com.dailymail.online), v5.2.14 (186)	Daily Mail Online	5,000,000
	Apple Daily 果動新聞 (com.nextmedia), v5.4.0 (5404)	Next Mobile Limited	5,000,000
	Podcast App: Free & Offline Podcasts by Player FM (fm.player), v4.12.0.239 (17261)	Player FM Podcasts	5,000,000

(Table Continues)

Table 106 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
CAMERA	News Republic - Breaking and Trending News (com.mobilesrepublic.appy), v12.6.7.02 (12670002)	News Republic	50,000,000
	Reddit (com.reddit.frontpage), v2020.17.0 (267902)	reddit Inc.	10,000,000
	Podcast Player & Podcast App - Castbox (fm.castbox.audiobook.radio.podcast), v8.13.2-200509141 (200509141)	Castbox.FM - Radio & Podcast & AudioBooks	10,000,000
	TopBuzz News: Breaking, Local, Entertaining & FREE (com.ss.android.article.master), v10.1.7.02 (101702)	TopBuzz	10,000,000
	BaBe+ - Berita Indonesia (com.ss.android.article.master.id), v10.6.2.02 (106202)	Mainspring	5,000,000
RECORD_AUDIO	Reddit (com.reddit.frontpage), v2020.17.0 (267902)	reddit Inc.	10,000,000
	Podcast Player & Podcast App - Castbox (fm.castbox.audiobook.radio.podcast), v8.13.2-200509141 (200509141)	Castbox.FM - Radio & Podcast & AudioBooks	10,000,000
	BaBe+ - Berita Indonesia (com.ss.android.article.master.id), v10.6.2.02 (106202)	Mainspring	5,000,000
	Podcast App & Podcast Player - Podbean (com.podbean.app.podcast), v7.6.1 (761)	Podbean - Podcast & Radio & Audiobook	1,000,000
	20 Minuten (CH) (ch.iAgentur.i20Min), v20.0.7.1 (18823)	20 Minuten	1,000,000
CALL_PHONE	News Home: Breaking News, Local & World News Today (com.home.news.breaking), v2.8.5-news-home (2000805)	My Home Apps	1,000,000
	VnExpress.net (fr.playsoft.vnexpress), v7.8.5 (228)	VnExpress.net	1,000,000
	新浪新闻 (com.sina.news), v7.24.7 (437)	Sina.com	100,000
	今日澳洲 - 新闻移民租房招聘一手掌握 (au.com.nexty.today), v3.24.1 (2020042702)	Media Today Group Pty Ltd	100,000
WRITE_CALENDAR	新浪新闻 (com.sina.news), v7.24.7 (437)	Sina.com	100,000
READ_CALENDAR	新浪新闻 (com.sina.news), v7.24.7 (437)	Sina.com	100,000
WRITE_CONTACTS			

(Table Continues)

Table 106 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	今日澳洲 - 新移民留房招聘一手掌握 (au.com.nexty.today), v3.24.1 (2020042702)	Media Today Group Pty Ltd	100,000
READ_CONTACTS	今日澳洲 - 新移民留房招聘一手掌握 (au.com.nexty.today), v3.24.1 (2020042702)	Media Today Group Pty Ltd	100,000

Table 107 lists the 5 most popular News & Magazines apps that requested the most permissions, whereas Table 108 lists the 5 most popular News & Magazines apps that requested the fewest permissions.

Top 5 Apps	Developer	# of Installs	Permissions
今日澳洲 - 新移民租房招聘一手掌握 (au.com.nexty.today), v3.24.1 (2020042702)	Media Today Group Pty Ltd	100,000	40
新浪新闻 (com.sina.news), v7.24.7 (437)	Sina.com	100,000	39
News Home: Breaking News, Local & World News Today (com.home.news.breaking), v2.8.5-news-home (2000805)	My Home Apps	1,000,000	26
TopBuzz News: Breaking, Local, Entertaining & FREE (com.ss.android.article.master), v10.1.7.02 (101702)	TopBuzz	10,000,000	23
BaBe+ - Berita Indonesia (com.ss.android.article.master.id), v10.6.2.02 (106202)	Mainspring	5,000,000	22

Table 107: The 5 most popular News & Magazines apps that requested the most permissions.

Top 5 Apps	Developer	# of Installs	Permissions
Twitter (com.twitter.android), v8.43.0-release.00 (18430000)	Twitter, Inc.	500,000,000	0
Bangla Newspaper –Prothom Alo (com.mcc.prothomalo), v8.7 (100016)	Prothom Alo	1,000,000	4
France Press (com.lagoo.paris), v2.2 (20200)	Studio BabDreams	100,000	4
manager-magazin.de (de.spiegel.android.app.mmo), v1.4.12 (112)	manager magazin Verlagsgesellschaft mbH	50,000	5
News Suite by Sony (com.sony.nfx.app.sfr), v5.2.10.30.1 (16521030)	Sony Network Communications Inc.	50,000,000	6

Table 108: The 5 most popular News & Magazines apps that requested the least number of permissions.

D.4.2.2 Permission Usage While the previous subsection depicted the dangerous permissions *requested* by the apps that were tested, Table 109 lists the News & Magazines apps based on the dangerous permissions that were observed being *used* during the testing period.

Table 109: News & Magazines apps based on total number of permissions requested, the number of those that are considered “dangerous,” and the percentage of those dangerous permissions that were used during testing.

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
今日澳洲 - 新移民留房招聘一手掌握 (au.com.nexty.today), v3.24.1 (2020042702)	Media Today Group Pty Ltd	40	11	0.0
新浪新闻 (com.sina.news), v7.24.7 (437)	Sina.com	39	10	0.0
News Home: Breaking News, Local & World News Today (com.home.news.breaking), v2.8.5-news-home (2000805)	My Home Apps	26	5	40.0
TopBuzz News: Breaking, Local, Entertaining & FREE (com.ss.android.article.master), v10.1.7.02 (101702)	TopBuzz	23	5	40.0
BaBe+ - Berita Indonesia (com.ss.android.article.master.id), v10.6.2.02 (106202)	Mainspring	22	4	0.0
News Republic - Breaking and Trending News (com.mobilesrepublic.appy), v12.6.7.02 (12670002)	News Republic	20	3	0.0
Reddit (com.reddit.frontpage), v2020.17.0 (267902)	reddit Inc.	19	6	0.0
Podcast Player & Podcast App - Castbox (fm.castbox.audiobook.radio.podcast), v8.13.2-200509141 (200509141)	Castbox.FM - Radio & Podcast & AudioBooks	17	7	0.0
FM Córdoba (ar.com.cadena3.fmcordoba), v3.1.140 (24)	Cadena 3 Argentina	17	7	0.0
VnExpress.net (fr.playsoft.vnexpress), v7.8.5 (228)	VnExpress.net	17	8	0.0
Apple Daily 果動新聞 (com.nextmedia), v5.4.0 (5404)	Next Mobile Limited	17	6	16.7
Podcast Player (com.podcast.podcasts), v6.2.2-200407051.raa85500 (200407051)	Castbox.FM - Radio & Podcast & AudioBooks	14	4	0.0
rif is fun for Reddit (com.andrewshu.android.reddit), v4.16.12 (2512)	TalkLittle	14	3	0.0
CNN Breaking US & World News (com.cnn.mobile.android.phone), v6.9 (30199)	CNN	14	2	0.0
20 Minuten (CH)	20 Minuten	14	4	0.0

(Table Continues)

Table 109 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(ch.iAgentur.i20Min), v20.0.7.1 (18823)				
Daily Mail Online (com.dailymail.online), v5.2.14 (186)	Daily Mail Online	14	5	20.0
Australia Breaking News & Local News For Free (ma.safe.bnau), v10.5.1 (100501)	Safe Apps Inc	13	7	0.0
Google News: Top World & Local News Headlines (com.google.android.apps.magazines), v5.21.1.20032110 (2020032110)	Google LLC	13	2	0.0
Hindi News:Live India News, Live TV, Newspaper App (com.nbt.reader), v4.2.2.0 (4220)	Times Internet Limited	13	6	0.0
Podcast Addict (com.bambuna.podcastaddict), v2020.7.1 (20154)	Xavier Guillemene - Podcast & Radio Addict	13	2	0.0
The Guardian - Live World News, Sport & Opinion (com.guardian), v6.41.2312 (2312)	Guardian News & Media Ltd	13	2	0.0
Ukrainian news AllNews (gregory.network.rss), v3.1.92 (128)	ToEventWithFriends.com	13	4	75.0
Podcast App & Podcast Player - Podbean (com.podbean.app.podcast), v7.6.1 (761)	Podbean - Podcast & Radio & Audiobook	12	3	0.0
BBC News (bbc.mobile.news.ww), v5.12.0 (111155)	BBC Worldwide (Ltd)	11	1	0.0
Feedly - Smarter News Reader (com.devhd.feedly), v75.0.0 (790)	Feedly Team	10	2	0.0
Herald Sun (com.newscorp.heraldsun), v7.25.0 (171)	NDM	10	3	0.0
Podcast Republic - Podcast Player & Radio App (com.itunestoppodcastplayer.app), v20.5.11R (210995)	Podcast Republic	10	2	0.0
The Courier-Mail (com.newscorp.couriermail), v7.25.0 (171)	NDM	10	3	0.0
Sync for reddit (com.laurencedawson.reddit_sync), v19.0.3 (866)	Red Apps LTD	10	2	0.0
Stuff.co.nz (nz.co.stuff.android.news), v3.33.1 (946)	Stuff Limited	10	4	0.0
News18 Latest & Breaking News (com.divum.ibn), v7.5 (75)	Network18	10	2	0.0
News by The Times of India Newspaper - Latest News (com.toi.reader.activities), v5.7.9.2 (5792)	Times Internet Limited	10	3	0.0
Relay for reddit (free.reddit.news), v10.0.138 (464)	DBrady	10	3	0.0
The Advertiser	NDM	10	3	0.0

(Table Continues)

Table 109 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(com.newscorp.adelaideadvertiser), v7.25.0 (171)				
Quora — Ask Questions, Get Answers (com.quora.android), v2.8.52 (2045)	Quora, Inc.	9	2	0.0
Feedly Classic (com.devhd.feedly.classic), v39.0.1-classic (701)	Feedly Team	9	2	0.0
Podcast App: Free & Offline Podcasts by Player FM (fm.player), v4.12.0.239 (17261)	Player FM Podcasts	9	2	0.0
Good News Network (com.ml.goodnewsnetwork), v2.5 (20200507)	Geri Weis-Corbley	9	3	0.0
Thailand News in English (com.thailand.news.english), v1.0 (12)	Appachi	9	1	0.0
Nairaland Forum (com.compass.nairaland), v1.4 (27)	Softrealm Solutions	9	1	0.0
VicEmergency (com.naturallybeing.fireready), v6.2.3 (602030)	Department of Justice & Community Safety, Victoria	9	3	33.3
SmartNews: Local Breaking News (jp.gocro.smartnews.android), v7.7.0 (410)	SmartNews, Inc.	9	2	100.0
Pocket Casts - Podcast Player (au.com.shiftyjelly.pocketcasts), v7.8.3 (5436)	Podcast Media LLC	8	1	0.0
The Sydney Morning Herald (com.fairfaxmedia.ink.metro.smh), v2.1.0 (4446)	Fairfax Media	8	3	0.0
The Age (com.fairfaxmedia.ink.metro.age), v2.1.0 (4446)	Fairfax Media	8	3	0.0
Joey for Reddit (o.o.joey), v1.8.6.2 (294)	CodesForLiving	8	2	0.0
Le Point : actualités et journal d'informations (fr.lepoint.android), v8.1.2 (8010206)	Le Point	8	2	0.0
Ready For Reddit - Material 2.0 (com.devgary.ready), v2.5.0 (84)	Gary Wong	8	3	0.0
Dnevnik.hr (com.cme.newsreader.dnevnik.hr), v1.3 (19)	Nova TV d.d.	8	3	0.0
news.com.au (com.newscorp.newscomau.app), v1.5.3 (25)	NDM	8	3	0.0
9NEWS (nineNewsAlerts.nine.com), v2.12.0 (105)	NINE NETWORK AUSTRALIA PTY LTD	8	2	100.0
Boost for reddit (com.rubenmayayo.reddit), v1.10.0 (143)	Rubén Mayayo	7	2	0.0
BaconReader for Reddit	OneLouder Apps	7	1	0.0

(Table Continues)

Table 109 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(com.onelouder.baconreader), v5.7.0 (123)				
Palabre Feedly RSS Reader News (com.levelup.palabre), v3.2.4 (3020400)	LevelUp Studio	7	2	0.0
EL PAÍS (com.elpais.elpais), v2.10.0 (441)	El País	7	1	0.0
ANI News (com.ani.news), v3.2 (302)	ANI News	7	2	0.0
Son Dakika Haberleri (appstoxe.habersondakika), v3.54 (35400000)	Appstoxe Uygulama Merkezi	7	2	0.0
ABC NEWS (android.AbcApplication), v6.6.2 (4787)	Australian Broadcasting Corporation	6	1	0.0
Polish Newspapers (com.tachanfil.polskiegazety), v5.0.5 (505)	MUNBEN	6	2	0.0
News Suite by Sony (com.sony.nfx.app.sfr), v5.2.10.30.1 (16521030)	Sony Network Communications Inc.	6	0	0.0
T24 (com.opera.t24), v2.1.1 (19)	T24 Bağımsız internet gazetesi	6	0	0.0
DER SPIEGEL (de.spiegel.android.app.spon), v4.1.0 (160)	DER SPIEGEL GmbH & Co. KG	6	1	0.0
manager-magazin.de (de.spiegel.android.app.mmo), v1.4.12 (112)	manager magazin Verlagsgesellschaft mbH	5	1	0.0
France Press (com.lagoo.paris), v2.2 (20200)	Studio BabDreams	4	1	0.0
Bangla Newspaper –Prothom Alo (com.mcc.prothomalo), v8.7 (100016)	Prothom Alo	4	0	0.0

D.4.3 Third-Party SDKs

We were able to identify 180 SDKs embedded within the 66 News & Magazines apps. We list the 40 most common SDKs in Table 110,¹²⁸ along with the number of News & Magazines apps in which they were detected.

Table 110: The 40 most common SDKs identified within apps in the News & Magazines category.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	65	(98.5%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	65	(98.5%)
Google Gson	Google	Development Aid	52	(78.8%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	51	(77.3%)
Google Ads	Google	Advertisement	50	(75.8%)
Google DoubleClick	Google	Advertisement	47	(71.2%)
Glide	Bump Technologies	Development Aid	46	(69.7%)
Crashlytics	Google	Mobile Analytics	45	(68.2%)
picasso	Square Inc.	Development Aid	32	(48.5%)
ZXing ('Zebra Crossing')	ZXing Project	Development Aid	31	(47.0%)
Github	Github	Development Aid	31	(47.0%)
Facebook Login	Facebook	Digital Identity Advertisement Mobile Analytics	30	(45.5%)
Facebook Share	Facebook	Social Network Advertisement	29	(43.9%)

(Table Continues)

¹²⁸For an explanation of SDKs, see Section 4.1.2.

Table 110 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
		Mobile Analytics		
Facebook Analytics	Facebook	Mobile Analytics	27	(40.9%)
Google Play	Google Play	App Market	27	(40.9%)
Apache Common	The Apache Software Founda- tion	Development Aid	25	(37.9%)
Google Core Libraries for Java 6+	Google	Development Aid	23	(34.8%)
Facebook Ads	Facebook	Advertisement	23	(34.8%)
Jsoup	Jsoup	Development Aid	23	(34.8%)
Facebook Places	Facebook	Map/LBS Advertisement	22	(33.3%)
Google Analytics	Google	Mobile Analytics	21	(31.8%)
YouTube Android Player API	Google	Development Aid	21	(31.8%)
Google Tag Manager	Google	Mobile Analytics	19	(28.8%)
Google Protocol Buffers	Google	Development Aid	18	(27.3%)
MoPub	Twitter	Advertisement	18	(27.3%)
Moat	Oracle	Mobile Analytics	14	(21.2%)
Volley HTTP library	Google	Development Aid Networking	12	(18.2%)
Fasterxml	FasterXML	Utility	12	(18.2%)
OkHttp	OkHttp	Development Aid	12	(18.2%)
MaterialProgressBar	MaterialProgressBar	Development Aid	12	(18.2%)
Integral Ad Science	Integral Ad Science Inc.	Mobile Analytics Advertisement AdFraud	11	(16.7%)
Amazon Advertisement	Amazon	Advertisement	10	(15.2%)
SLF4J	SLF4J	Development Aid	10	(15.2%)
Nine Old Androids	Nine Old Androids	Development Aid	10	(15.2%)
Joda Time	Stephen Colebourne	Development Aid	9	(13.6%)
RxJava Retrofit	RxJava Retrofit	Development Aid	9	(13.6%)

(Table Continues)

Table 110 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Flurry	Verizon	Mobile Analytics	8	(12.1%)
JavaX Annotation API	JavaX Annotation API	Utility	8	(12.1%)
comscore	Comscore	Mobile Analytics	8	(12.1%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	8	(12.1%)

Several of these SDKs included developer tools, which we characterize as SDKs that provide tools and functionality to app developers which are unlikely to be used for the transmission of user information. As a result, we separately present Table 111, which depicts the 40 most common SDKs with developer tools removed, along with the number of News & Magazines apps in which they were detected.

Table 111: The 40 most common SDKs identified within apps in the News & Magazines category, with developer tools removed.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	65	(98.5%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	65	(98.5%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	51	(77.3%)
Google Ads	Google	Advertisement	50	(75.8%)
Google DoubleClick	Google	Advertisement	47	(71.2%)
Crashlytics	Google	Mobile Analytics	45	(68.2%)
Facebook Login	Facebook	Digital Identity	30	(45.5%)

(Table Continues)

Table 111 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
		Advertisement Mobile Analytics		
Facebook Share	Facebook	Social Network Advertisement Mobile Analytics	29	(43.9%)
Facebook Analytics	Facebook	Mobile Analytics	27	(40.9%)
Google Play	Google Play	App Market	27	(40.9%)
Facebook Ads	Facebook	Advertisement	23	(34.8%)
Facebook Places	Facebook	Map/LBS Advertisement	22	(33.3%)
Google Analytics	Google	Mobile Analytics	21	(31.8%)
Google Tag Manager	Google	Mobile Analytics	19	(28.8%)
MoPub	Twitter	Advertisement	18	(27.3%)
Moat	Oracle	Mobile Analytics	14	(21.2%)
Volley HTTP library	Google	Development Aid Networking	12	(18.2%)
Integral Ad Science	Integral Ad Science Inc.	Mobile Analytics Advertisement AdFraud	11	(16.7%)
Amazon Advertisement	Amazon	Advertisement	10	(15.2%)
Flurry	Verizon	Mobile Analytics	8	(12.1%)
comscore	Comscore	Mobile Analytics	8	(12.1%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	8	(12.1%)
Brightcove	Brightcove	Advertisement	8	(12.1%)
Inmobi	InMobi	Advertisement	6	(9.1%)
Nielsen	Nielsen	Mobile Analytics	5	(7.6%)
getui	getui	Advertisement Mobile Analytics Push Notifications	5	(7.6%)

(Table Continues)

Table 111 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
urbanairship	Airship	Mobile Analytics	5	(7.6%)
OutBrain	Outbrain	Advertisement	5	(7.6%)
Chartbeat	Chartbeat	Mobile Analytics	4	(6.1%)
Taboola	Taboola	Advertisement	4	(6.1%)
Teads	Teads	Advertisement	4	(6.1%)
Microsoft Appcenter Analytics	Microsoft	Mobile Analytics	4	(6.1%)
Microsoft Appcenter Crashes	Microsoft	Mobile Analytics	4	(6.1%)
OneSignal	OneSignal	Mobile Analytics	4	(6.1%)
Salesforce Marketing Cloud	Salesforce	Advertisement	4	(6.1%)
Snowplow	Snowplow Analytics	Mobile Analytics	3	(4.5%)
Branch	Branch Metrics	Mobile Analytics Advertisement	3	(4.5%)
Krux	Salesforce	Mobile Analytics	3	(4.5%)
Instabug	Instabug	Mobile Analytics	3	(4.5%)
AppMonet	Monet Engine Inc.	Advertisement	3	(4.5%)

D.5 Productivity Apps

D.5.1 Data Types Transmitted

Apps in the Productivity category were observed transmitting the data types listed in Table 112 during the testing period.¹²⁹

Data Type	# of Apps	(% of Apps)
AAID	23	(41.1%)
Android ID	19	(33.9%)
Email	9	(16.1%)
Name	5	(8.9%)
WiFi MAC	1	(1.8%)
BT Name	1	(1.8%)

Table 112: Data types transmitted by apps in the Productivity category during the testing period.

¹²⁹For an explanation of these data types, see Section 3.

D.5.1.1 Most Common Hostnames Contacted

Table 113 depicts the top 10 hostnames observed being contacted by Productivity apps during the testing period, whereas Table 114 depicts the top 10 parent companies corresponding to these hostnames. This data reflects Internet servers that were *contacted* by apps, but does not necessarily mean that they received sensitive user information—we specifically discuss that subset of recipients in Section D.5.1.2.¹³⁰ The discrepancy between the two sections is due to the fact that some app transmissions may simply not contain sensitive user information or that its transmission was obfuscated using a method that we did not immediately recognize.

Hostname	Parent Company	# of Apps	(% of Apps)
settings.crashlytics.com	Google	19	(33.9%)
firebaseremoteconfig.googleapis.com	Google	14	(25.0%)
graph.facebook.com	Facebook	14	(25.0%)
googleads.g.doubleclick.net	Google	10	(17.9%)
lh3.googleusercontent.com	Google	9	(16.1%)
firebaseinstallations.googleapis.com	Google	9	(16.1%)
pagead2.googleadservices.com	Google	8	(14.3%)
app.adjust.com	Adjust	8	(14.3%)
www.googleapis.com	Google	6	(10.7%)
tpc.google syndication.com	Google	6	(10.7%)

Table 113: The top 10 most common hostnames contacted by Productivity apps during testing.

Company	# of Apps	(% of Apps)
Google	37	(66.1%)
Facebook	14	(25.0%)
Microsoft	8	(14.3%)
Adjust	8	(14.3%)
AppsFlyer	6	(10.7%)
Verizon	6	(10.7%)
Liftoff	3	(5.4%)
Kochava	3	(5.4%)
Twitter	2	(3.6%)
Amplitude	2	(3.6%)

¹³⁰We define “user information” in Section 3.

Company	# of Apps	(% of Apps)
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Table 114: The top 10 most common companies contacted by Productivity apps during testing.

D.5.1.2 Most Common Data Recipients

Table 115 depicts the top 10 data recipients among the Productivity apps during the testing period. Table 116 lists additional information about the most common data recipients, such as the approximate locations of their servers, IP addresses contacted during testing, and the types of sensitive user information that we observed them receive during the testing period.

Hostname	Parent Company	# of Apps	(% of Apps)
graph.facebook.com	Facebook	12	(21.4%)
app.adjust.com	Adjust	8	(14.3%)
data.flurry.com	Verizon	6	(10.7%)
www.googleapis.com	Google	5	(8.9%)
www.facebook.com	Facebook	3	(5.4%)
control.kochava.com	Kochava	3	(5.4%)
launches.appsflyer.com	AppsFlyer	2	(3.6%)
telemetry.api.swiftkey.com	Microsoft	2	(3.6%)
mobile.pipe.aria.microsoft.com	Microsoft	2	(3.6%)
t.appsflyer.com	AppsFlyer	2	(3.6%)

Table 115: The top 10 most common data recipients from Productivity apps during testing.

Table 116: The 10 most common recipient hostnames of user information from Productivity apps during the testing period, along with their IP addresses, company information, and the data types that were observed being transmitted.

Parent Company	Country	IPs	Received Data
<code>graph.facebook.com</code>			
Facebook	United States	157.240.8.18 (US)	Android ID AAID Email
<code>app.adjust.com</code>			
Adjust	United States	185.151.204.10 (DE) 185.151.204.8 (DE) 185.151.204.13 (DE) 185.151.204.9 (DE) 185.151.204.14 (DE) 185.151.204.7 (DE)	AAID
<code>data.flurry.com</code>			
Verizon	United States	115.178.9.19 (HK) 115.178.9.18 (HK)	Android ID AAID
<code>www.googleapis.com</code>			
Google	United States	172.217.167.106 (US) 172.217.167.74 (US) 216.58.199.42 (US) 142.250.67.10 (US) 216.58.196.138 (US)	Email Name
<code>control.kochava.com</code>			
Kochava	United States	107.178.254.148 (US)	BT Name Android ID AAID
<code>www.facebook.com</code>			
Facebook	United States	157.240.8.35 (US)	AAID
<code>mobile.pipe.aria.microsoft.com</code>			
Microsoft	United States	52.114.7.38 (HK) 52.114.159.22 (US)	Android ID AAID

(Table Continues)

Table 116 (Continued)

Parent Company	Country	IPs	Received Data
t.appsflyer.com			
AppsFlyer	United States	54.229.43.99 (IE) 52.214.82.234 (IE)	Android ID AAID
launches.appsflyer.com			
AppsFlyer	United States	34.250.242.46 (IE) 34.247.199.249 (IE) 34.252.37.26 (IE)	AAID
telemetry.api.swiftkey.com			
Microsoft	United States	52.210.226.38 (IE) 52.31.211.37 (IE)	AAID

D.5.1.3 Apps Ranked by Number of Recipients

Table 117 ranks the Productivity apps based on the number of recipients to which we detected each transmit sensitive user information during testing.

Table 117: Productivity apps ordered by the number of recipients (by unique hostnames and their parent companies) during the testing period.

App	Developer	Installs	Recipients	
			Hostnames	Companies
Email Providers All-in-one Mailbox, Secure, Free Package Name: comm.mailboxall.inone Version: 8.0 (71)	Elevite Mob	1,000,000	9	7
Alarm Clock with Missions & Loud Ringtones -Alarmy Package Name: droom.sleepIfUCan Version: 4.22.4 (42204)	Alarm Clock Alarmy	10,000,000	6	5
Universal Email App Package Name: park.hotm.email.app Version: 11.13.1.29164 (29164)	Craigpark Limited	1,000,000	8	5
Email Accounts All in One, Free Secure Mailboxes Package Name: com.mailsall.inonemailboxapp Version: 1.5.0 (9)	Alpem Mobile	1,000,000	6	5
Microsoft Outlook: Organize Your Email & Calendar Package Name: com.microsoft.office.outlook Version: 4.1.80 (200276)	Microsoft Corporation	100,000,000	4	4
Email - Lightning Fast & Secure Mail Package Name: com.easilydo.mail Version: 1.14.2 (150)	Edison Software	1,000,000	5	4
Evernote - Notes Organizer & Daily Planner Package Name: com.evernote Version: 8.13.2 (1083315)	Evernote Corporation	100,000,000	3	3
Mobile Security: VPN Proxy & Anti Theft Safe WiFi Package Name: com.wsandroid.suite Version: 5.6.0.178 (5600178)	McAfee LLC	50,000,000	3	3
Email Blue Mail - Calendar & Tasks Package Name: me.bluelmail.mail Version: 1.9.7.32 (15860)	Blix Inc.	5,000,000	5	3
Hamro Patro : The Best Nepali Patro Package Name: com.hamropatro Version: 16.5.9 (631)	Hamro Patro	5,000,000	4	3
BlockerX-Porn Blocker/Website Blocker for Studying Package Name: io.funswitch.blocker Version: 4.0.09 (4009)	FunSwitch Technologies	100,000	4	3

(Table Continues)

Table 117 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Microsoft OneDrive Package Name: com.microsoft.skydrive Version: 6.3.2 (2026030602)	Microsoft Corporation	1,000,000,000	3	2
Adobe Acrobat Reader: PDF Viewer, Editor & Creator Package Name: com.adobe.reader Version: 20.3.0.12688 (1920312688)	Adobe	500,000,000	2	2
Your Phone Companion - Link to Windows Package Name: com.microsoft.appmanager Version: 1.20052.145.0 (330289)	Microsoft Corporation	100,000,000	4	2
Alarm Clock Xtreme: Alarm, Reminders, Timer (Free) Package Name: com.alarmclock.xtreme.free Version: 6.11.0 (70002271)	AVG Labs	50,000,000	5	2
Grammarly Keyboard —Type with confidence Package Name: com.grammarly.android.keyboard Version: 1.8.15.1 (10801501)	Grammarly, Inc.	10,000,000	3	2
Todoist: To-Do List, Tasks & Reminders Package Name: com.todoist Version: 15.6.0 (7402)	Doist	10,000,000	2	2
LastPass Password Manager Package Name: com.lastpass.lpandroid Version: 4.11.8.5429 (411085429)	LogMeIn, Inc.	5,000,000	4	2
SwiftKey Beta Package Name: com.touchtype.swiftkey.beta Version: 7.5.5.15 (950337776)	SwiftKey	1,000,000	2	2
ai.type Free Emoji Keyboard 2020 Package Name: com.aitype.android.f Version: Free-9.6.1.9 (96019)	ai.type	1,000,000	3	2
Swapps! All Apps, Everywhere Package Name: com.schiztech.swapps Version: 2.3.4 (36)	SchizTech	500,000	2	2
Google Drive Package Name: com.google.android.apps.docs Version: 2.20.181.04.40 (201810440)	Google LLC	5,000,000,000	1	1
Google Calendar Package Name: com.google.android.calendar Version: 2020.16.3-310130200-release (2016593052)	Google LLC	1,000,000,000	1	1
SwiftKey Keyboard Package Name: com.touchtype.swiftkey Version: 7.5.4.4 (950272064)	SwiftKey	500,000,000	1	1
Google Keep - Notes and Lists Package Name: com.google.android.keep	Google LLC	500,000,000	1	1

(Table Continues)

Table 117 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Version: 5.20.181.03.40 (201810340) ColorNote Notepad Notes Package Name: com.socialnmobile.dictapps.notepad.color.note Version: 4.1.4 (11400)	Notes	100,000,000	1	1
Zoho Mail - Email and Calendar Package Name: com.zoho.mail Version: 2.4.15.3 (101)	Zoho Corporation	1,000,000	1	1
Boxer - Workspace ONE Package Name: com.boxer.email Version: 5.17.0.3 (1612)	Boxer	1,000,000	1	1
AppBlock - Stay Focused (Block Websites & Apps) Package Name: cz.mobilesoft.appblock Version: 4.3.10 (165)	MobileSoft s.r.o.	1,000,000	1	1
Spark -Email App by Readdle Package Name: com.readdle.spark Version: 2.5.0 (20500300)	Readdle Inc.	500,000	1	1
Firefox Preview Package Name: org.mozilla.fenix Version: 5.0.0 (21212137)	Mozilla	500,000	1	1
Mail Master Package Name: com.netease.mail Version: 6.22.1 (205)	NetEase	100,000	2	1
GQueues Tasks & To-Do Lists Package Name: com.gqueues.android.app Version: 1.6.7 (67)	GQueues	50,000	1	1
Google PDF Viewer Package Name: com.google.android.apps.pdfviewer Version: 2.19.381.03.40 (193810340)	Google LLC	50,000,000	0	0
Ridmik Keyboard Package Name: ridmik.keyboard Version: 5.5.1 (38)	Ridmik Labs	10,000,000	0	0
Chrome Beta Package Name: com.chrome.beta Version: 83.0.4103.44 (410304423)	Google LLC	10,000,000	0	0
Call Recorder - Automatic Call Recorder - callX Package Name: com.smsrobot.callrecorder Version: 8.3 (74)	SMSROBOT LTD (Auto Call Recorder, Period Tracker)	10,000,000	0	0
Notepad Free Package Name: com.atomczak.notepad Version: 1.9.0 (41)	atomczak	5,000,000	0	0
Express Plus Centrelink	Services Australia (Table Continues)	1,000,000	0	0

Table 117 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Package Name: au.gov.dhs.centrelinkexpressplus Version: 3.26.0 (168)				
Stay Focused - App Block & Website Block Package Name: com.stayfocused Version: 5.0.1 (294)	Innoxapps	1,000,000	0	0
BlackBerry Launcher Package Name: com.blackberry.blackberrylauncher Version: 2.1902.1.10150 (129)	BlackBerry Limited	1,000,000	0	0
Loop Habit Tracker Package Name: org.isoron.uhabits Version: 1.7.11 (38)	Álison S Xavier	1,000,000	0	0
Arabic keyboard: Arabic Language Keyboard Package Name: com.arabic.keyboard.arabic.language.keyboard.app Version: 1.3 (4)	Simple Keyboard, theme & emoji	1,000,000	0	0
Alarm Clock for Heavy Sleepers —Loud + Smart Math Package Name: com.amdroidalarmclock.amdroid Version: 4.9.2 (226)	AMdroid Alarm Clock - No more oversleep	1,000,000	0	0
YourHour - Phone Addiction Tracker & Controller Package Name: com.mindefy.phoneaddiction.mobilepe Version: 1.9.164 (164)	Mindefy Labs	1,000,000	0	0
شاميم شاميم شاميم شاميم شاميم 99 Package Name: shamimsoft.shamimyas Version: google-6.8 (68)	ShamimSoft	1,000,000	0	0
BlackBerry Work Package Name: com.good.gcs Version: 3.1.0.1467 (203425211)	BlackBerry Ltd	1,000,000	0	0
Minuum Keyboard Free + Emoji Package Name: com.whirlscape.minuumfree Version: 3.5.2 (129)	Whirlscape	500,000	0	0
Notch Notifications for MIUI Package Name: zanini.andrea.notchtest Version: 2.0.1568 (1568)	Andrea Zanini	100,000	0	0
D Notes - Smart & Material - Notes, Lists & Photos Package Name: com.dvdb.bergnotes Version: 2.1.25 (40)	Damian van den Berg	100,000	0	0
Block Apps - Productivity & Digital Wellbeing Package Name: com.wverlaek.block Version: 3.0.0 (52)	WVerlaek	100,000	0	0
Webmail Aruba.it Package Name: com.aruba.aruba.it Version: 1.3.0 (103000)	Aruba S.p.A.	100,000	0	0

(Table Continues)

Table 117 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
myGovID Package Name: au.gov.ato.mygovid.droid Version: 1.6.1.4 (1060104)	Australian Taxation Office	100,000	0	0
a decluttered launcher - minimalism & productivity Package Name: com.declutter.adeclutteredlauncher Version: beta3 (65)	declutter	10,000	0	0
Rushfiles Package Name: com.rushfiles.cloudrive Version: 4.3.5 (428)	RushFiles A/S	10,000	0	0
Pluckeye Package Name: net.pluckeye.tober Version: 66.0.5 (2015635241)	Single Eye Software	1,000	0	0

D.5.1.4 Popular Apps Transmitting Each Data Type

For each of these data types, Table 118 lists the top 5 most popular Productivity apps that we observed transmitting them during testing.¹³¹

Table 118: The top 5 Productivity apps that we detected transmitting each data type during the testing period.

Data Type	Top 5 Apps	Developer	# of Installs
AAID	Microsoft OneDrive (com.microsoft.skydrive), v6.3.2 (2026030602)	Microsoft Corporation	1,000,000,000
	Adobe Acrobat Reader: PDF Viewer, Editor & Creator (com.adobe.reader), v20.3.0.12688 (1920312688)	Adobe	500,000,000
	SwiftKey Keyboard (com.touchtype.swiftkey), v7.5.4.4 (950272064)	SwiftKey	500,000,000
	Microsoft Outlook: Organize Your Email & Calendar (com.microsoft.office.outlook), v4.1.80 (200276)	Microsoft Corporation	100,000,000
	Evernote - Notes Organizer & Daily Planner (com.evernote), v8.13.2 (1083315)	Evernote Corporation	100,000,000
Android ID	Microsoft OneDrive (com.microsoft.skydrive), v6.3.2 (2026030602)	Microsoft Corporation	1,000,000,000
	Adobe Acrobat Reader: PDF Viewer, Editor & Creator (com.adobe.reader), v20.3.0.12688 (1920312688)	Adobe	500,000,000
	Microsoft Outlook: Organize Your Email & Calendar (com.microsoft.office.outlook), v4.1.80 (200276)	Microsoft Corporation	100,000,000
	ColorNote Notepad Notes (com.socialnmobile.dictapps.notepad.color.note), v4.1.4 (11400)	Notes	100,000,000
	Evernote - Notes Organizer & Daily Planner (com.evernote), v8.13.2 (1083315)	Evernote Corporation	100,000,000
Email	Google Drive (com.google.android.apps.docs), v2.20.181.04.40 (201810440)	Google LLC	5,000,000,000
	Google Calendar (com.google.android.calendar), v2020.16.3-310130200-release (2016593052)	Google LLC	1,000,000,000
	Google Keep - Notes and Lists (com.google.android.keep), v5.20.181.03.40 (201810340)	Google LLC	500,000,000
	Evernote - Notes Organizer & Daily Planner (com.evernote), v8.13.2 (1083315)	Evernote Corporation	100,000,000
	Todoist: To-Do List, Tasks & Reminders	Doist	10,000,000

(Table Continues)

¹³¹ Popularity is determined by the number of reported installs in the Google Play Store.

Table 118 (Continued)

Data Type	Top 5 Apps	Developer	# of Installs
	(com.todoist), v15.6.0 (7402)		
Name	Google Drive (com.google.android.apps.docs), v2.20.181.04.40 (201810440)	Google LLC	5,000,000,000
	Evernote - Notes Organizer & Daily Planner (com.evernote), v8.13.2 (1083315)	Evernote Corporation	100,000,000
	Email Blue Mail - Calendar & Tasks (me.bluelmail.mail), v1.9.7.32 (15860)	Blix Inc.	5,000,000
	BlockerX-Porn Blocker/Website Blocker for Studying (io.funswitch.blocker), v4.0.09 (4009)	FunSwitch Technologies	100,000
	GQueues Tasks & To-Do Lists (com.gqueues.android.app), v1.6.7 (67)	GQueues	50,000
WiFi MAC	Universal Email App (park.hotm.email.app), v11.13.1.29164 (29164)	Craigpark Limited	1,000,000
BT Name	Email Providers All-in-one Mailbox, Secure, Free (comm.mailboxall.inone), v8.0 (71)	Elevite Mob	1,000,000

Table 119 lists the 5 most popular Productivity apps that transmitted the most data types during the testing period, whereas Table 120 lists the 5 most popular Productivity apps that transmitted the fewest data types during the testing period.

Top 5 Apps	Developer	# of Installs	Data Types
Evernote - Notes Organizer & Daily Planner (com.evernote), v8.13.2 (1083315)	Evernote Corporation	100,000,000	4
Email - Lightning Fast & Secure Mail (com.easilydo.mail), v1.14.2 (150)	Edison Software	1,000,000	3
Universal Email App (park.hotm.email.app), v11.13.1.29164 (29164)	Craigpark Limited	1,000,000	3
Email Providers All-in-one Mailbox, Secure, Free (comm.mailboxall.inone), v8.0 (71)	Elevite Mob	1,000,000	3
BlockerX-Porn Blocker/Website Blocker for Studying (io.funswitch.blocker), v4.0.09 (4009)	FunSwitch Technologies	100,000	3

Table 119: The top 5 Productivity apps that transmitted the most data types during testing.

Top 5 Apps	Developer	# of Installs	Data Types
Google PDF Viewer (com.google.android.apps.pdfviewer), v2.19.381.03.40 (193810340)	Google LLC	50,000,000	0
Ridmik Keyboard (ridmik.keyboard), v5.5.1 (38)	Ridmik Labs	10,000,000	0
Chrome Beta (com.chrome.beta), v83.0.4103.44 (410304423)	Google LLC	10,000,000	0
Call Recorder - Automatic Call Recorder - callX (com.smsrobot.callrecorder), v8.3 (74)	SMSROBOT LTD (Auto Call Recorder, Period Tracker)	10,000,000	0
Notepad Free (com.atomczak.notepad), v1.9.0 (41)	atomczak	5,000,000	0

Table 120: The top 5 Productivity apps that transmitted the fewest data types during testing.

D.5.2 App Permissions

Apps in the Productivity category requested the dangerous permissions listed in Table 121.¹³²

Data Type	# of Apps	(% of Apps)
WRITE_EXTERNAL_STORAGE	45	(80.4%)
READ_EXTERNAL_STORAGE	35	(62.5%)
GET_ACCOUNTS	29	(51.8%)
READ_CONTACTS	23	(41.1%)
CAMERA	22	(39.3%)
ACCESS_FINE_LOCATION	20	(35.7%)
READ_PHONE_STATE	19	(33.9%)
RECORD_AUDIO	15	(26.8%)
ACCESS_COARSE_LOCATION	14	(25.0%)
READ_CALENDAR	11	(19.6%)
WRITE_CONTACTS	10	(17.9%)
CALL_PHONE	8	(14.3%)
WRITE_CALENDAR	6	(10.7%)
ACCESS_BACKGROUND_LOCATION	3	(5.4%)
ANSWER_PHONE_CALLS	2	(3.6%)
SEND_SMS	1	(1.8%)
READ_SMS	1	(1.8%)
READ_CALL_LOG	1	(1.8%)

Table 121: Dangerous permissions requested by apps in the Productivity category.

¹³²For an explanation of dangerous permissions, see Section 4.3.

D.5.2.1 Popular Apps Requesting Dangerous Permissions For each of these permissions, Table 122 lists the top 5 most popular apps that we observed requesting dangerous permissions during testing.¹³³

Table 122: The 5 most popular Productivity apps that requested each dangerous permission.

Permission	Top 5 Apps	Developer	# of Installs
WRITE_EXTERNAL_STORAGE	Google Drive (com.google.android.apps.docs), v2.20.181.04.40 (201810440)	Google LLC	5,000,000,000
	Microsoft OneDrive (com.microsoft.skydrive), v6.3.2 (2026030602)	Microsoft Corporation	1,000,000,000
	Adobe Acrobat Reader: PDF Viewer, Editor & Creator (com.adobe.reader), v20.3.0.12688 (1920312688)	Adobe	500,000,000
	SwiftKey Keyboard (com.touchtype.swiftkey), v7.5.4.4 (950272064)	SwiftKey	500,000,000
	Google Keep - Notes and Lists (com.google.android.keep), v5.20.181.03.40 (201810340)	Google LLC	500,000,000
READ_EXTERNAL_STORAGE	Google Drive (com.google.android.apps.docs), v2.20.181.04.40 (201810440)	Google LLC	5,000,000,000
	Microsoft OneDrive (com.microsoft.skydrive), v6.3.2 (2026030602)	Microsoft Corporation	1,000,000,000
	Microsoft Outlook: Organize Your Email & Calendar (com.microsoft.office.outlook), v4.1.80 (200276)	Microsoft Corporation	100,000,000
	Evernote - Notes Organizer & Daily Planner (com.evernote), v8.13.2 (1083315)	Evernote Corporation	100,000,000
	Your Phone Companion - Link to Windows (com.microsoft.appmanager), v1.20052.145.0 (330289)	Microsoft Corporation	100,000,000
GET_ACCOUNTS	Google Drive (com.google.android.apps.docs), v2.20.181.04.40 (201810440)	Google LLC	5,000,000,000
	Google Calendar (com.google.android.calendar), v2020.16.3-310130200-release (2016593052)	Google LLC	1,000,000,000
	Microsoft OneDrive (com.microsoft.skydrive), v6.3.2 (2026030602)	Microsoft Corporation	1,000,000,000
	Adobe Acrobat Reader: PDF Viewer, Editor & Creator (com.adobe.reader), v20.3.0.12688 (1920312688)	Adobe	500,000,000
	SwiftKey Keyboard (com.touchtype.swiftkey), v7.5.4.4 (950272064)	SwiftKey	500,000,000

(Table Continues)

¹³³Popularity is determined by the number of reported installs in the Google Play Store.

Table 122 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(com.touchtype.swiftkey), v7.5.4.4 (950272064)		
READ_CONTACTS			
	Google Drive (com.google.android.apps.docs), v2.20.181.04.40 (201810440)	Google LLC	5,000,000,000
	Google Calendar (com.google.android.calendar), v2020.16.3-310130200-release (2016593052)	Google LLC	1,000,000,000
	Microsoft OneDrive (com.microsoft.skydrive), v6.3.2 (2026030602)	Microsoft Corporation	1,000,000,000
	Adobe Acrobat Reader: PDF Viewer, Editor & Creator (com.adobe.reader), v20.3.0.12688 (1920312688)	Adobe	500,000,000
	Google Keep - Notes and Lists (com.google.android.keep), v5.20.181.03.40 (201810340)	Google LLC	500,000,000
CAMERA			
	Google Drive (com.google.android.apps.docs), v2.20.181.04.40 (201810440)	Google LLC	5,000,000,000
	Microsoft OneDrive (com.microsoft.skydrive), v6.3.2 (2026030602)	Microsoft Corporation	1,000,000,000
	Adobe Acrobat Reader: PDF Viewer, Editor & Creator (com.adobe.reader), v20.3.0.12688 (1920312688)	Adobe	500,000,000
	Microsoft Outlook: Organize Your Email & Calendar (com.microsoft.office.outlook), v4.1.80 (200276)	Microsoft Corporation	100,000,000
	Evernote - Notes Organizer & Daily Planner (com.evernote), v8.13.2 (1083315)	Evernote Corporation	100,000,000
ACCESS_FINE_LOCATION			
	Google Keep - Notes and Lists (com.google.android.keep), v5.20.181.03.40 (201810340)	Google LLC	500,000,000
	Microsoft Outlook: Organize Your Email & Calendar (com.microsoft.office.outlook), v4.1.80 (200276)	Microsoft Corporation	100,000,000
	Evernote - Notes Organizer & Daily Planner (com.evernote), v8.13.2 (1083315)	Evernote Corporation	100,000,000
	Your Phone Companion - Link to Windows (com.microsoft.appmanager), v1.20052.145.0 (330289)	Microsoft Corporation	100,000,000
	Alarm Clock Xtreme: Alarm, Reminders, Timer (Free) (com.alarmclock.xtreme.free), v6.11.0 (70002271)	AVG Labs	50,000,000
READ_PHONE_STATE			
	Microsoft OneDrive (com.microsoft.skydrive), v6.3.2 (2026030602)	Microsoft Corporation	1,000,000,000
	Evernote - Notes Organizer & Daily Planner (com.evernote), v8.13.2 (1083315)	Evernote Corporation	100,000,000

(Table Continues)

Table 122 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	Your Phone Companion - Link to Windows (com.microsoft.appmanager), v1.20052.145.0 (330289)	Microsoft Corporation	100,000,000
	Alarm Clock Xtreme: Alarm, Reminders, Timer (Free) (com.alarmclock.xtreme.free), v6.11.0 (70002271)	AVG Labs	50,000,000
	Mobile Security: VPN Proxy & Anti Theft Safe WiFi (com.wsandroid.suite), v5.6.0.178 (5600178)	McAfee LLC	50,000,000
RECORD_AUDIO			
	Google Keep - Notes and Lists (com.google.android.keep), v5.20.181.03.40 (201810340)	Google LLC	500,000,000
	Microsoft Outlook: Organize Your Email & Calendar (com.microsoft.office.outlook), v4.1.80 (200276)	Microsoft Corporation	100,000,000
	Evernote - Notes Organizer & Daily Planner (com.evernote), v8.13.2 (1083315)	Evernote Corporation	100,000,000
	Ridmik Keyboard (ridmik.keyboard), v5.5.1 (38)	Ridmik Labs	10,000,000
	Chrome Beta (com.chrome.beta), v83.0.4103.44 (410304423)	Google LLC	10,000,000
ACCESS_COARSE_LOCATION			
	Google Calendar (com.google.android.calendar), v2020.16.3-310130200-release (2016593052)	Google LLC	1,000,000,000
	Evernote - Notes Organizer & Daily Planner (com.evernote), v8.13.2 (1083315)	Evernote Corporation	100,000,000
	Mobile Security: VPN Proxy & Anti Theft Safe WiFi (com.wsandroid.suite), v5.6.0.178 (5600178)	McAfee LLC	50,000,000
	Alarm Clock with Missions & Loud Ringtones -Alarmy (droom.sleepfulUCan), v4.22.4 (42204)	Alarm Clock Alarmy	10,000,000
	Chrome Beta (com.chrome.beta), v83.0.4103.44 (410304423)	Google LLC	10,000,000
READ_CALENDAR			
	Google Calendar (com.google.android.calendar), v2020.16.3-310130200-release (2016593052)	Google LLC	1,000,000,000
	Microsoft Outlook: Organize Your Email & Calendar (com.microsoft.office.outlook), v4.1.80 (200276)	Microsoft Corporation	100,000,000
	Evernote - Notes Organizer & Daily Planner (com.evernote), v8.13.2 (1083315)	Evernote Corporation	100,000,000
	Alarm Clock Xtreme: Alarm, Reminders, Timer (Free) (com.alarmclock.xtreme.free), v6.11.0 (70002271)	AVG Labs	50,000,000
	Email Blue Mail - Calendar & Tasks	Blix Inc.	5,000,000

(Table Continues)

Table 122 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(me.bluelmail.mail), v1.9.7.32 (15860)		
WRITE_CONTACTS			
	Microsoft Outlook: Organize Your Email & Calendar (com.microsoft.office.outlook), v4.1.80 (200276)	Microsoft Corporation	100,000,000
	Mobile Security: VPN Proxy & Anti Theft Safe WiFi (com.wsandroid.suite), v5.6.0.178 (5600178)	McAfee LLC	50,000,000
	Call Recorder - Automatic Call Recorder - callX (com.smsrobot.callrecorder), v8.3 (74)	SMSROBOT LTD (Auto Call Recorder, Period Tracker)	10,000,000
	Email Blue Mail - Calendar & Tasks (me.bluelmail.mail), v1.9.7.32 (15860)	Blix Inc.	5,000,000
	Email - Lightning Fast & Secure Mail (com.easilydo.mail), v1.14.2 (150)	Edison Software	1,000,000
CALL_PHONE			
	Mobile Security: VPN Proxy & Anti Theft Safe WiFi (com.wsandroid.suite), v5.6.0.178 (5600178)	McAfee LLC	50,000,000
	Call Recorder - Automatic Call Recorder - callX (com.smsrobot.callrecorder), v8.3 (74)	SMSROBOT LTD (Auto Call Recorder, Period Tracker)	10,000,000
	Express Plus Centrelink (au.gov.dhs.centrelinkexpressplus), v3.26.0 (168)	Services Australia	1,000,000
	BlackBerry Launcher (com.blackberry.blackberrylauncher), v2.1902.1.10150 (129)	BlackBerry Limited	1,000,000
	Boxer - Workspace ONE (com.boxer.email), v5.17.0.3 (1612)	Boxer	1,000,000
WRITE_CALENDAR			
	Google Calendar (com.google.android.calendar), v2020.16.3-310130200-release (2016593052)	Google LLC	1,000,000,000
	Microsoft Outlook: Organize Your Email & Calendar (com.microsoft.office.outlook), v4.1.80 (200276)	Microsoft Corporation	100,000,000
	Email Blue Mail - Calendar & Tasks (me.bluelmail.mail), v1.9.7.32 (15860)	Blix Inc.	5,000,000
	Email - Lightning Fast & Secure Mail (com.easilydo.mail), v1.14.2 (150)	Edison Software	1,000,000
	Boxer - Workspace ONE (com.boxer.email), v5.17.0.3 (1612)	Boxer	1,000,000
ACCESS_BACKGROUND_LOCATION			
	Google Keep - Notes and Lists (com.google.android.keep), v5.20.181.03.40 (201810340)	Google LLC	500,000,000
	Mobile Security: VPN Proxy & Anti Theft Safe WiFi (com.wsandroid.suite), v5.6.0.178 (5600178)	McAfee LLC	50,000,000

(Table Continues)

Table 122 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	Todoist: To-Do List, Tasks & Reminders (com.todoist), v15.6.0 (7402)	Doist	10,000,000
ANSWER_PHONE_CALLS	Mobile Security: VPN Proxy & Anti Theft Safe WiFi (com.wsandroid.suite), v5.6.0.178 (5600178)	McAfee LLC	50,000,000
	Email Accounts All in One, Free Secure Mailboxes (com.mailsall.inonemailboxapp), v1.5.0 (9)	Alpem Mobile	1,000,000
SEND_SMS	Your Phone Companion - Link to Windows (com.microsoft.appmanager), v1.20052.145.0 (330289)	Microsoft Corporation	100,000,000
READ_SMS	Your Phone Companion - Link to Windows (com.microsoft.appmanager), v1.20052.145.0 (330289)	Microsoft Corporation	100,000,000
READ_CALL_LOG	Your Phone Companion - Link to Windows (com.microsoft.appmanager), v1.20052.145.0 (330289)	Microsoft Corporation	100,000,000

Table 123 lists the 5 most popular Productivity apps that requested the most permissions, whereas Table 124 lists the 5 most popular Productivity apps that requested the fewest permissions.

Top 5 Apps	Developer	# of Installs	Permissions
Mobile Security: VPN Proxy & Anti Theft Safe WiFi (com.wsandroid.suite), v5.6.0.178 (5600178)	McAfee LLC	50,000,000	53
Boxer - Workspace ONE (com.boxer.email), v5.17.0.3 (1612)	Boxer	1,000,000	29
BlackBerry Launcher (com.blackberry.blackberrylauncher), v2.1902.1.10150 (129)	BlackBerry Limited	1,000,000	27
BlackBerry Work (com.good.gcs), v3.1.0.1467 (203425211)	BlackBerry Ltd	1,000,000	27
Mail Master (com.netease.mail), v6.22.1 (205)	NetEase	100,000	27

Table 123: The 5 most popular Productivity apps that requested the most permissions.

Top 5 Apps	Developer	# of Installs	Permissions
Loop Habit Tracker (org.isoron.uhabits), v1.7.11 (38)	Álison S Xavier	1,000,000	4
Notepad Free (com.atomczak.notepad), v1.9.0 (41)	atomczak	5,000,000	5
a decluttered launcher - minimalism & productivity (com.declutter.adeclutteredlauncher), vbeta3 (65)	declutter	10,000	5
ColorNote Notepad Notes (com.socialmobile.dictapps.notepad.color.note), v4.1.4 (11400)	Notes	100,000,000	6
Arabic keyboard: Arabic Language Keyboard (com.arabic.keyboard.arabic.language.keyboard.app), v1.3 (4)	Simple Keyboard, theme & emoji	1,000,000	6

Table 124: The 5 most popular Productivity apps that requested the least number of permissions.

D.5.2.2 Permission Usage While the previous subsection depicted the dangerous permissions *requested* by the apps that were tested, Table 125 lists the Productivity apps based on the dangerous permissions that were observed being *used* during the testing period.

Table 125: Productivity apps based on total number of permissions requested, the number of those that are considered “dangerous,” and the percentage of those dangerous permissions that were used during testing.

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
Mobile Security: VPN Proxy & Anti Theft Safe WiFi (com.wsandroid.suite), v5.6.0.178 (5600178)	McAfee LLC	53	12	8.3
Boxer - Workspace ONE (com.boxer.email), v5.17.0.3 (1612)	Boxer	29	10	0.0
BlackBerry Launcher (com.blackberry.blackberrylauncher), v2.1902.1.10150 (129)	BlackBerry Limited	27	4	0.0
BlackBerry Work (com.good.gcs), v3.1.0.1467 (203425211)	BlackBerry Ltd	27	9	0.0
Mail Master (com.netease.mail), v6.22.1 (205)	NetEase	27	11	0.0
Microsoft Outlook: Organize Your Email & Calendar (com.microsoft.office.outlook), v4.1.80 (200276)	Microsoft Corporation	25	10	0.0
Your Phone Companion - Link to Windows (com.microsoft.appmanager), v1.20052.145.0 (330289)	Microsoft Corporation	25	10	0.0
Email Blue Mail - Calendar & Tasks (me.bluelmail.mail), v1.9.7.32 (15860)	Blix Inc.	24	7	0.0
Pluckeye (net.pluckeye.tober), v66.0.5 (2015635241)	Single Eye Software	24	7	0.0
Evernote - Notes Organizer & Daily Planner (com.evernote), v8.13.2 (1083315)	Evernote Corporation	24	9	33.3
Chrome Beta (com.chrome.beta), v83.0.4103.44 (410304423)	Google LLC	23	7	0.0
Alarm Clock with Missions & Loud Ringtones -Alarmy (droom.sleepIfUCan), v4.22.4 (42204)	Alarm Clock Alarmy	22	5	0.0
Google Drive (com.google.android.apps.docs), v2.20.181.04.40 (201810440)	Google LLC	22	5	0.0
Microsoft OneDrive (com.microsoft.skydrive), v6.3.2 (2026030602)	Microsoft Corporation	22	6	0.0
LastPass Password Manager (com.lastpass.lpandroid), v4.11.8.5429 (411085429)	LogMeIn, Inc.	22	7	0.0
Email - Lightning Fast & Secure Mail (com.easilydo.mail), v1.14.2 (150)	Edison Software	22	8	12.5

(Table Continues)

Table 125 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
Alarm Clock for Heavy Sleepers —Loud + Smart Math (com.amdroidalarmclock.amdroid), v4.9.2 (226)	AMdroid Alarm Clock - No more oversleep	19	6	0.0
Universal Email App (park.hotm.email.app), v11.13.1.29164 (29164)	Craigpark Limited	19	5	0.0
Call Recorder - Automatic Call Recorder - callX (com.smsrobot.callrecorder), v8.3 (74)	SMSROBOT LTD (Auto Call Recorder, Period Tracker)	19	8	0.0
Google Calendar (com.google.android.calendar), v2020.16.3-310130200-release (2016593052)	Google LLC	19	5	40.0
Google Keep - Notes and Lists (com.google.android.keep), v5.20.181.03.40 (201810340)	Google LLC	18	6	0.0
Zoho Mail - Email and Calendar (com.zoho.mail), v2.4.15.3 (101)	Zoho Corporation	18	4	0.0
Email Accounts All in One, Free Secure Mailboxes (com.mailsall.inonemailboxapp), v1.5.0 (9)	Alpem Mobile	18	8	0.0
Firefox Preview (org.mozilla.fenix), v5.0.0 (21212137)	Mozilla	17	6	16.7
Alarm Clock Xtreme: Alarm, Reminders, Timer (Free) (com.alarmclock.xtreme.free), v6.11.0 (70002271)	AVG Labs	16	7	0.0
Hamro Patro : The Best Nepali Patro (com.hamropatro), v16.5.9 (631)	Hamro Patro	16	5	0.0
ShamimSoft (shamimsoft.shamimyas), vgoogle-6.8 (68)	ShamimSoft	16	5	0.0
Adobe Acrobat Reader: PDF Viewer, Editor & Creator (com.adobe.reader), v20.3.0.12688 (1920312688)	Adobe	14	4	0.0
YourHour - Phone Addiction Tracker & Controller (com.mindefy.phoneaddiction.mobilepe), v1.9.164 (164)	Mindefy Labs	14	3	0.0
Email Providers All-in-one Mailbox, Secure, Free (comm.mailboxall.inone), v8.0 (71)	Elevite Mob	14	6	0.0
ai.type Free Emoji Keyboard 2020 (com.aitype.android.f), vFree-9.6.1.9 (96019)	ai.type	14	6	0.0
Express Plus Centrelink (au.gov.dhs.centrelinkexpressplus), v3.26.0 (168)	Services Australia	13	6	0.0
Grammarly Keyboard —Type with confidence (com.grammarly.android.keyboard), v1.8.15.1 (10801501)	Grammarly, Inc.	12	1	0.0
Stay Focused - App Block & Website Block (com.stayfocused), v5.0.1 (294)	Innoxapps	12	2	0.0
AppBlock - Stay Focused (Block Websites & Apps) (cz.mobilesoft.appblock), v4.3.10 (165)	MobileSoft s.r.o.	12	1	0.0

(Table Continues)

Table 125 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
Ridmik Keyboard (ridmik.keyboard), v5.5.1 (38)	Ridmik Labs	11	3	0.0
GQueues Tasks & To-Do Lists (com.gqueues.android.app), v1.6.7 (67)	GQueues	11	4	0.0
Spark –Email App by Readdle (com.readdle.spark), v2.5.0 (20500300)	Readdle Inc.	10	2	0.0
Block Apps - Productivity & Digital Wellbeing (com.wverlaek.block), v3.0.0 (52)	WVerlaek	10	0	0.0
D Notes - Smart & Material - Notes, Lists & Photos (com.dvdb.bergnotes), v2.1.25 (40)	Damian van den Berg	10	3	66.7
Todoist: To-Do List, Tasks & Reminders (com.todoist), v15.6.0 (7402)	Doist	9	4	0.0
Minuum Keyboard Free + Emoji (com.whirlscape.minuumfree), v3.5.2 (129)	Whirlscape	9	3	0.0
SwiftKey Beta (com.touchtype.swiftkey.beta), v7.5.5.15 (950337776)	SwiftKey	8	2	0.0
SwiftKey Keyboard (com.touchtype.swiftkey), v7.5.4.4 (950272064)	SwiftKey	8	2	0.0
Swapps! All Apps, Everywhere (com.schiztech.swapps), v2.3.4 (36)	SchizTech	8	1	0.0
Notch Notifications for MIUI (zanini.andrea.notchtest), v2.0.1568 (1568)	Andrea Zanini	8	2	0.0
Google PDF Viewer (com.google.android.apps.pdfviewer), v2.19.381.03.40 (193810340)	Google LLC	8	3	0.0
Webmail Aruba.it (com.aruba.aruba.it), v1.3.0 (103000)	Aruba S.p.A.	8	4	0.0
myGovID (au.gov.ato.mygovid.droid), v1.6.1.4 (1060104)	Australian Taxation Office	8	1	0.0
Rushfiles (com.rushfiles.clouddrive), v4.3.5 (428)	RushFiles A/S	7	3	0.0
BlockerX-Porn Blocker/Website Blocker for Studying (io.funswitch.blocker), v4.0.09 (4009)	FunSwitch Technologies	7	0	0.0
ColorNote Notepad Notes (com.socialnmobile.dictapps.notepad.color.note), v4.1.4 (11400)	Notes	6	1	0.0
Arabic keyboard: Arabic Language Keyboard (com.arabic.keyboard.arabic.language.keyboard.app), v1.3 (4)	Simple Keyboard, theme & emoji	6	2	0.0

(Table Continues)

Table 125 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
Notepad Free (com.atomczak.notepat), v1.9.0 (41)	atomczak	5	1	0.0
a decluttered launcher - minimalism & productivity (com.declutter.adeclutteredlauncher), vbeta3 (65)	declutter	5	1	0.0
Loop Habit Tracker (org.isoron.uhabits), v1.7.11 (38)	Álinson S Xavier	4	2	0.0

D.5.3 Third-Party SDKs

We were able to identify 163 SDKs embedded within the 56 Productivity apps. We list the 40 most common SDKs in Table 126,¹³⁴ along with the number of Productivity apps in which they were detected.

Table 126: The 40 most common SDKs identified within apps in the Productivity category.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	50	(89.3%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	48	(85.7%)
Google Gson	Google	Development Aid	36	(64.3%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	28	(50.0%)
Google Core Libraries for Java 6+	Google	Development Aid	25	(44.6%)
Apache Common	The Apache Software Foundation	Development Aid	22	(39.3%)
Crashlytics	Google	Mobile Analytics	22	(39.3%)
Google Ads	Google	Advertisement	21	(37.5%)
picasso	Square Inc.	Development Aid	21	(37.5%)
ZXing ('Zebra Crossing')	ZXing Project	Development Aid	21	(37.5%)
Github	Github	Development Aid	20	(35.7%)
Google Protocol Buffers	Google	Development Aid	20	(35.7%)
Google Analytics	Google	Mobile Analytics	17	(30.4%)
Google DoubleClick	Google	Advertisement	17	(30.4%)
Glide	Bump Technologies	Development Aid	16	(28.6%)

(Table Continues)

¹³⁴For an explanation of SDKs, see Section 4.1.2.

Table 126 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Play	Google Play	App Market	15	(26.8%)
Google Tag Manager	Google	Mobile Analytics	14	(25.0%)
Facebook Login	Facebook	Digital Identity Advertisement Mobile Analytics	13	(23.2%)
Facebook Ads	Facebook	Advertisement	12	(21.4%)
Facebook Analytics	Facebook	Mobile Analytics	12	(21.4%)
Facebook Share	Facebook	Social Network Advertisement Mobile Analytics	12	(21.4%)
Google Core Libraries (3rd Party)	Google	Development Aid	11	(19.6%)
Volley HTTP library	Google	Development Aid Networking	11	(19.6%)
Fasterxml	FasterXML	Utility	11	(19.6%)
JavaX Annotation API	JavaX Annotation API	Utility	10	(17.9%)
Apache Http	The Apache Software Founda- tion	Development Aid	9	(16.1%)
Facebook Places	Facebook	Map/LBS Advertisement	8	(14.3%)
adjust	Adjust	Mobile Analytics Advertisement	8	(14.3%)
Google API Client Libraries	Google	Development Framework	8	(14.3%)
SLF4J	SLF4J	Development Aid	7	(12.5%)
Flurry	Verizon	Mobile Analytics	7	(12.5%)
Android ViewPagerindicator Widget	Jake Wharton	Development Aid	7	(12.5%)
Jsoup	Jsoup	Development Aid	6	(10.7%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	6	(10.7%)
Moat	Oracle	Mobile Analytics	6	(10.7%)

(Table Continues)

Table 126 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
MoPub	Twitter	Advertisement	6	(10.7%)
Joda Time	Stephen Colebourne	Development Aid	6	(10.7%)
Mobeta ListView	Mobeta ListView	GUI Component	5	(8.9%)
Apache James Mail Enterprise Serve	The Apache Software Founda- tion	Development Aid	5	(8.9%)
Integral Ad Science	Integral Ad Science Inc.	Mobile Analytics Advertisement AdFraud	5	(8.9%)

Several of these SDKs included developer tools, which we characterize as SDKs that provide tools and functionality to app developers which are unlikely to be used for the transmission of user information. As a result, we separately present Table 127, which depicts the 40 most common SDKs with developer tools removed, along with the number of Productivity apps in which they were detected.

Table 127: The 40 most common SDKs identified within apps in the Productivity category, with developer tools removed.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	50	(89.3%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	48	(85.7%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	28	(50.0%)
Crashlytics	Google	Mobile Analytics	22	(39.3%)

(Table Continues)

Table 127 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Ads	Google	Advertisement	21	(37.5%)
Google Analytics	Google	Mobile Analytics	17	(30.4%)
Google DoubleClick	Google	Advertisement	17	(30.4%)
Google Play	Google Play	App Market	15	(26.8%)
Google Tag Manager	Google	Mobile Analytics	14	(25.0%)
Facebook Login	Facebook	Digital Identity Advertisement Mobile Analytics	13	(23.2%)
Facebook Ads	Facebook	Advertisement	12	(21.4%)
Facebook Analytics	Facebook	Mobile Analytics	12	(21.4%)
Facebook Share	Facebook	Social Network Advertisement Mobile Analytics	12	(21.4%)
Volley HTTP library	Google	Development Aid Networking	11	(19.6%)
Facebook Places	Facebook	Map/LBS Advertisement	8	(14.3%)
adjust	Adjust	Mobile Analytics Advertisement	8	(14.3%)
Flurry	Verizon	Mobile Analytics	7	(12.5%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	6	(10.7%)
Moat	Oracle	Mobile Analytics	6	(10.7%)
MoPub	Twitter	Advertisement	6	(10.7%)
Integral Ad Science	Integral Ad Science Inc.	Mobile Analytics Advertisement AdFraud	5	(8.9%)
Inmobi	InMobi	Advertisement	4	(7.1%)
Microsoft Appcenter Crashes	Microsoft	Mobile Analytics	4	(7.1%)
HockeyApp	Microsoft	Mobile Analytics	4	(7.1%)

(Table Continues)

Table 127 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Amazon Advertisement	Amazon	Advertisement	3	(5.4%)
Amplitude	Amplitude	Mobile Analytics	3	(5.4%)
getui	getui	Advertisement Mobile Analytics Push Notifications	3	(5.4%)
MixPanel	Mixpanel	Mobile Analytics	3	(5.4%)
IronSource	IronSource	Advertisement Mobile Analytics	3	(5.4%)
Unity3D	Unity Technologies	Game Engine Mobile Analytics Advertisement	3	(5.4%)
Unity3d Ads	Unity Technologies	Advertisement	3	(5.4%)
Inneractive	Fyber	Advertisement	2	(3.6%)
Instabug	Instabug	Mobile Analytics	2	(3.6%)
Smaato	Smaato	Advertisement LBS	2	(3.6%)
Microsoft Appcenter Analytics	Microsoft	Mobile Analytics	2	(3.6%)
AppNexus	xandr	Advertisement	2	(3.6%)
Tencent Login	Tencent	Social Network	2	(3.6%)
AdColony	AdColony	Advertisement	2	(3.6%)
Applovin	AppLovin	Advertisement	2	(3.6%)
myTarget	My.com	Advertisement Social Networking	2	(3.6%)

D.6 Social Apps

D.6.1 Data Types Transmitted

Apps in the Social category were observed transmitting the data types listed in Table 128 during the testing period.¹³⁵

Data Type	# of Apps	(% of Apps)
AAID	31	(75.6%)
Android ID	23	(56.1%)
GPS Location	9	(22.0%)
Coarse Location	9	(22.0%)
Email	6	(14.6%)
Name	5	(12.2%)
WiFi SSID	3	(7.3%)
WiFi MAC	3	(7.3%)
WiFi BSSID	2	(4.9%)
Serial #	1	(2.4%)
BT Name	1	(2.4%)
IMEI	1	(2.4%)
IMSI	1	(2.4%)

Table 128: Data types transmitted by apps in the Social category during the testing period.

¹³⁵For an explanation of these data types, see Section 3.

D.6.1.1 Most Common Hostnames Contacted

Table 129 depicts the top 10 hostnames observed being contacted by Social apps during the testing period, whereas Table 130 depicts the top 10 parent companies corresponding to these hostnames. This data reflects Internet servers that were *contacted* by apps, but does not necessarily mean that they received sensitive user information—we specifically discuss that subset of recipients in Section D.6.1.2.¹³⁶ The discrepancy between the two sections is due to the fact that some app transmissions may simply not contain sensitive user information or that its transmission was obfuscated using a method that we did not immediately recognize.

Hostname	Parent Company	# of Apps	(% of Apps)
settings.crashlytics.com	Google	24	(58.5%)
graph.facebook.com	Facebook	22	(53.7%)
firebaseremoteconfig.googleapis.com	Google	14	(34.1%)
googleads.g.doubleclick.net	Google	12	(29.3%)
www.facebook.com	Facebook	8	(19.5%)
ads.mopub.com	Twitter	7	(17.1%)
gcdsdk.appsflyer.com	AppsFlyer	6	(14.6%)
conversions.appsflyer.com	AppsFlyer	6	(14.6%)
cdn.liftoff.io	Liftoff	6	(14.6%)
tpc.google syndication.com	Google	6	(14.6%)

Table 129: The top 10 most common hostnames contacted by Social apps during testing.

Company	# of Apps	(% of Apps)
Google	30	(73.2%)
Facebook	27	(65.9%)
AppsFlyer	11	(26.8%)
Twitter	8	(19.5%)
Amazon	8	(19.5%)
Verizon	6	(14.6%)
Liftoff	6	(14.6%)
NTP.org	6	(14.6%)
Fyber	4	(9.8%)
InMobi	4	(9.8%)

Table 130: The top 10 most common companies contacted by Social apps during testing.

¹³⁶We define “user information” in Section 3.

D.6.1.2 Most Common Data Recipients

Table 131 depicts the top 10 data recipients among the Social apps during the testing period. Table 132 lists additional information about the most common data recipients, such as the approximate locations of their servers, IP addresses contacted during testing, and the types of sensitive user information that we observed them receive during the testing period.

Hostname	Parent Company	# of Apps	(% of Apps)
graph.facebook.com	Facebook	19	(46.3%)
ads.mopub.com	Twitter	6	(14.6%)
launches.appsflyer.com	AppsFlyer	5	(12.2%)
aax-us-east.amazon-adsystem.com	Amazon	5	(12.2%)
s.amazon-adsystem.com	Amazon	5	(12.2%)
data.flurry.com	Verizon	4	(9.8%)
config.inmobi.com	InMobi	4	(9.8%)
app.adjust.com	Adjust	4	(9.8%)
www.facebook.com	Facebook	4	(9.8%)
t.appsflyer.com	AppsFlyer	4	(9.8%)

Table 131: The top 10 most common data recipients from Social apps during testing.

Table 132: The 10 most common recipient hostnames of user information from Social apps during the testing period, along with their IP addresses, company information, and the data types that were observed being transmitted.

Parent Company	Country	IPs	Received Data
graph.facebook.com			
Facebook	United States	157.240.8.18 (US)	AAID
ads.mopub.com			
Twitter	United States	192.48.236.11 (US) 192.48.236.12 (US) 192.48.236.9 (US) 192.48.236.10 (US)	GPS Location Coarse Location AAID
aax-us-east.amazon-adsystem.com			
Amazon	United States	52.46.150.229 (US) 52.119.197.183 (US) 52.46.142.198 (US)	GPS Location Coarse Location AAID
launches.appsflyer.com			
AppsFlyer	United States	63.32.242.5 (IE) 52.214.200.82 (IE) 54.154.242.135 (IE) 34.243.167.89 (IE) 108.128.82.85 (IE)	AAID
s.amazon-adsystem.com			
Amazon	United States	52.94.232.32 (US) 72.21.206.140 (US) 54.239.17.112 (US) 52.46.130.13 (US)	AAID
data.flurry.com			
Verizon	United States	115.178.9.19 (HK) 115.178.9.18 (HK)	Android ID AAID
app.adjust.com			
(Table Continues)			

Table 132 (Continued)

Parent Company	Country	IPs	Received Data
Adjust	United States	185.151.204.7 (DE) 185.151.204.14 (DE) 185.151.204.13 (DE) 185.151.204.10 (DE)	Android ID AAID
t.appsflyer.com			
AppsFlyer	United States	52.17.191.169 (IE) 54.77.108.122 (IE) 52.215.103.61 (IE) 54.194.83.169 (IE)	Android ID AAID
config.inmobi.com			
InMobi	India	104.45.180.93 (US)	AAID
www.facebook.com			
Facebook	United States	157.240.8.35 (US)	AAID

D.6.1.3 Apps Ranked by Number of Recipients

Table 133 ranks the Social apps based on the number of recipients to which we detected each transmit sensitive user information during testing.

Table 133: Social apps ordered by the number of recipients (by unique hostnames and their parent companies) during the testing period.

App	Developer	Installs	Recipients	
			Hostnames	Companies
Messenger Package Name: messenger.social.chat.apps Version: 1.3.3 (133)	Text Free & Free Call & SMS & MMS & Messenger Team	10,000,000	18	12
SKOUT - Meet, Chat, Go Live Package Name: com.skout.android Version: 6.20.0 (1460)	Skout Inc.	50,000,000	19	11
MeetMe: Chat & Meet New People Package Name: com.myearbook.m Version: 14.12.6.2535 (2535)	MeetMe.com	50,000,000	15	10
hi5 - meet, chat & flirt Package Name: com.hi5.app Version: 9.26.0 (1374)	lfwe Inc.	10,000,000	11	8
Houseparty Package Name: com.herzick.houseparty Version: 1.41.1 (48682)	Life on Air	10,000,000	8	7
Messenger for Messages,Video Chat,Call ID for Free Package Name: messenger.chat.social.messenger.life Version: 1.4.7 (147)	Messenger Pro : Free Texts & Messages by AppyHigh	10,000,000	8	7
Tellonym: Honest Q&A Package Name: de.tellonym.app Version: 2.41.2 (300)	Callosum Software	10,000,000	11	6
Messenger for Messages,Chat,Video,Text,Call ID Package Name: messenger.chat.social.messenger Version: 3.19.0 (350)	Messenger Pro : Free Texts & Messages by AppyHigh	50,000,000	5	5
Grindr - Gay chat Package Name: com.grindrapp.android Version: 6.9.0 (72428)	Grindr LLC	10,000,000	6	5
Amino: Communities and Chats Package Name: com.narviil.amino.master Version: 3.3.33204 (33204)	Amino Apps	10,000,000	6	5
Tagged - Meet, Chat & Dating Package Name: com.taggedapp Version: 9.25.1 (1366)	lfwe Inc.	10,000,000	5	5

(Table Continues)

Table 133 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Messenger App for Free Video messages, Video Calls Package Name: messenger.video.call.chat.free Version: 1.3.6 (37)	Messenger Pro : Free Texts & Messages by AppyHigh	1,000,000	5	5
디자인사이드 - dcinside Package Name: com.dcinside.app Version: 3.8.2 (30201)	dcinside	500,000	8	5
VK—live chatting & free calls Package Name: com.vkontakte.android Version: 6.2 (5112)	VK.com	100,000,000	4	4
Badoo —Dating App to Chat, Date & Meet New People Package Name: com.badoo.mobile Version: 5.169.1 (3346)	Badoo	100,000,000	5	3
IMVU - Game with 3D Avatars, Chat and Real Friends Package Name: com.imvu.mobilecordova Version: 5.3.2.50302006 (50302006)	IMVU, Inc.	10,000,000	3	3
Yubo: Make New Friends - Meet & Chat Livestream Package Name: co.yellw.yellowapp Version: 3.109.0 (20017379)	Twelve APP	5,000,000	4	3
Sikh World Package Name: com.khushwant.sikhworld Version: 30.2 (211)	Khushwant Singh	1,000,000	7	3
Mimi 4chan Reader Package Name: com.emogoth.android.phone.mimi Version: 6.0.4 (220)	Mimi Reader	1,000,000	5	3
TikTok - Make Your Day Package Name: com.zhiliaoapp.musically Version: 15.7.45 (2021507450)	TikTok Inc.	1,000,000,000	2	2
Tumblr Package Name: com.tumblr Version: 15.9.0.01 (115090001)	Tumblr, Inc	100,000,000	5	2
Bigo Live - Live Stream, Live Video & Live Chat Package Name: sg.bigo.live Version: 4.34.4 (1703)	BIGO TECHNOLOGY PTE. LTD.	100,000,000	3	2
微博 Package Name: com.sina.weibo Version: 10.4.3 (4410)	Sina.com	10,000,000	2	2
SCRUFF Package Name: com.appspot.scruffapp Version: 6.1802 (10398)	Perry Street Software	5,000,000	2	2
Oasis Dating - 100% Free Chat Package Name: com.oasis.wrapper	3HGroupPtyLtd	500,000	2	2

(Table Continues)

Table 133 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Version: 2.0.840[0..8] (840) Social detective Package Name: com.social.detective Version: 20 (20)	Profile detective tools	500,000	6	2
Facebook Lite Package Name: com.facebook.lite Version: 197.1.0.17.125 (212922040)	Facebook	1,000,000,000	1	1
Plenty of Fish Free Dating App Package Name: com.pof.android Version: 4.16.0.1419827 (1419827)	Plentyoffish Media ULC	50,000,000	1	1
네이버 카페 - Naver Cafe Package Name: com.nhn.android.navercafe Version: 4.13.0.3 (19000039)	NAVER Corp.	10,000,000	1	1
Wickr Me -Private Messenger Package Name: com.mywickr.wickr2 Version: 5.53.8 (5530813)	Wickr Inc	5,000,000	1	1
The Fast Video Messenger App for Video Calling Package Name: com.messenger.videocall.messenger Version: 3.2.10 (139)	Messenger Family: Free messenger & live video chat	5,000,000	1	1
TextFun : Free Texting & Calling Package Name: com.textfun.text.free.call Version: 2.0.6 (206)	SMS Messenger	1,000,000	1	1
Messengers for Collection Social Package Name: free.group.chat.social.messenger Version: 26.0 (26)	messagedevteam	1,000,000	1	1
BlindStory - Watch, Download Stories for Instagram Package Name: com.storystalker.forinstagram Version: 1.0.15 (15)	Easypeek	50,000	1	1
Facebook Package Name: com.facebook.katana Version: 269.0.0.50.127 (212783074)	Facebook	5,000,000,000	0	0
Instagram Package Name: com.instagram.android Version: 140.0.0.30.126 (212676898)	Instagram	1,000,000,000	0	0
Telegram X Package Name: org.thunderdog.challegram Version: 0.22.6.1314-arm64-v8a (1314020)	Telegram LLC	10,000,000	0	0
MeWe Package Name: com.mewe Version: 6.2.4.0 (6240000)	MeWe	1,000,000	0	0

(Table Continues)

Table 133 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Friendly for Facebook Package Name: io.friendly Version: 4.4.07 (1103)	Friendly App Studio	1,000,000	0	0
Dark Social Package Name: org.nightmode.dark.social Version: 1.2.3 (108)	Night Mode Labs	1,000,000	0	0
PortSIP Softphone Package Name: com.portgo Version: 9.5.1 (951)	PortSIP	50,000	0	0

D.6.1.4 Popular Apps Transmitting Each Data Type

For each of these data types, Table 134 lists the top 5 most popular Social apps that we observed transmitting them during testing.¹³⁷

Table 134: The top 5 Social apps that we detected transmitting each data type during the testing period.

Data Type	Top 5 Apps	Developer	# of Installs
AAID	TikTok - Make Your Day (com.zhiliaoapp.musically), v15.7.45 (2021507450)	TikTok Inc.	1,000,000,000
	Facebook Lite (com.facebook.lite), v197.1.0.17.125 (212922040)	Facebook	1,000,000,000
	Tumblr (com.tumblr), v15.9.0.01 (115090001)	Tumblr, Inc	100,000,000
	Badoo —Dating App to Chat, Date & Meet New People (com.badoo.mobile), v5.169.1 (3346)	Badoo	100,000,000
	Bigo Live - Live Stream, Live Video & Live Chat (sg.bigo.live), v4.34.4 (1703)	BIGO TECHNOLOGY PTE. LTD.	100,000,000
Android ID	TikTok - Make Your Day (com.zhiliaoapp.musically), v15.7.45 (2021507450)	TikTok Inc.	1,000,000,000
	Tumblr (com.tumblr), v15.9.0.01 (115090001)	Tumblr, Inc	100,000,000
	VK —live chatting & free calls (com.vkontakte.android), v6.2 (5112)	VK.com	100,000,000
	SKOUT - Meet, Chat, Go Live (com.skout.android), v6.20.0 (1460)	Skout Inc.	50,000,000
	Messenger for Messages,Chat,Video,Text,Call ID (messenger.chat.social.messenger), v3.19.0 (350)	Messenger Pro : Free Texts & Messages by AppyHigh	50,000,000
GPS Location	SKOUT - Meet, Chat, Go Live (com.skout.android), v6.20.0 (1460)	Skout Inc.	50,000,000
	Messenger for Messages,Chat,Video,Text,Call ID (messenger.chat.social.messenger), v3.19.0 (350)	Messenger Pro : Free Texts & Messages by AppyHigh	50,000,000
	MeetMe: Chat & Meet New People (com.myearbook.m), v14.12.6.2535 (2535)	MeetMe.com	50,000,000
	Grindr - Gay chat (com.grindrapp.android), v6.9.0 (72428)	Grindr LLC	10,000,000
	Messenger for Messages,Video Chat,Call ID for Free (messenger.chat.social.messenger.lite), v1.4.7 (147)	Messenger Pro : Free Texts & Messages by AppyHigh	10,000,000

(Table Continues)

¹³⁷Popularity is determined by the number of reported installs in the Google Play Store.

Table 134 (Continued)

Data Type	Top 5 Apps	Developer	# of Installs
Coarse Location	SKOUT - Meet, Chat, Go Live (com.skout.android), v6.20.0 (1460)	Skout Inc.	50,000,000
	Messenger for Messages,Chat,Video,Text,Call ID (messenger.chat.social.messenger), v3.19.0 (350)	Messenger Pro : Free Texts & Messages by AppyHigh	50,000,000
	MeetMe: Chat & Meet New People (com.myearbook.m), v14.12.6.2535 (2535)	MeetMe.com	50,000,000
	Grindr - Gay chat (com.grindrapp.android), v6.9.0 (72428)	Grindr LLC	10,000,000
	Messenger for Messages,Video Chat,Call ID for Free (messenger.chat.social.messenger.lite), v1.4.7 (147)	Messenger Pro : Free Texts & Messages by AppyHigh	10,000,000
Email	VK —live chatting & free calls (com.vkontakte.android), v6.2 (5112)	VK.com	100,000,000
	SKOUT - Meet, Chat, Go Live (com.skout.android), v6.20.0 (1460)	Skout Inc.	50,000,000
	Messenger for Messages,Chat,Video,Text,Call ID (messenger.chat.social.messenger), v3.19.0 (350)	Messenger Pro : Free Texts & Messages by AppyHigh	50,000,000
	Grindr - Gay chat (com.grindrapp.android), v6.9.0 (72428)	Grindr LLC	10,000,000
	Houseparty (com.herzick.houseparty), v1.41.1 (48682)	Life on Air	10,000,000
	Name	VK —live chatting & free calls (com.vkontakte.android), v6.2 (5112)	VK.com
	SKOUT - Meet, Chat, Go Live (com.skout.android), v6.20.0 (1460)	Skout Inc.	50,000,000
	Grindr - Gay chat (com.grindrapp.android), v6.9.0 (72428)	Grindr LLC	10,000,000
	Houseparty (com.herzick.houseparty), v1.41.1 (48682)	Life on Air	10,000,000
	hi5 - meet, chat & flirt (com.hi5.app), v9.26.0 (1374)	lfwe Inc.	10,000,000
WiFi SSID	VK —live chatting & free calls (com.vkontakte.android), v6.2 (5112)	VK.com	100,000,000
	Messenger for Messages,Chat,Video,Text,Call ID (messenger.chat.social.messenger), v3.19.0 (350)	Messenger Pro : Free Texts & Messages by AppyHigh	50,000,000
	Messenger for Messages,Video Chat,Call ID for Free (Table Continues)	Messenger Pro : Free Texts & Messages by AppyHigh	10,000,000

Table 134 (Continued)

Data Type	Top 5 Apps	Developer	# of Installs
	(messenger.chat.social.messenger.life), v1.4.7 (147)		
WiFi MAC	VK —live chatting & free calls (com.vkontakte.android), v6.2 (5112)	VK.com	100,000,000
	Messenger (messenger.social.chat.apps), v1.3.3 (133)	Text Free & Free Call & SMS & MMS & Messenger Team	10,000,000
	微博 (com.sina.weibo), v10.4.3 (4410)	Sina.com	10,000,000
WiFi BSSID	Messenger for Messages,Chat,Video,Text,Call ID (messenger.chat.social.messenger), v3.19.0 (350)	Messenger Pro : Free Texts & Messages by AppyHigh	50,000,000
	Messenger for Messages,Video Chat,Call ID for Free (messenger.chat.social.messenger.life), v1.4.7 (147)	Messenger Pro : Free Texts & Messages by AppyHigh	10,000,000
Serial #	Messenger (messenger.social.chat.apps), v1.3.3 (133)	Text Free & Free Call & SMS & MMS & Messenger Team	10,000,000
BT Name	Social detective (com.social.detective), v20 (20)	Profile detective tools	500,000
IMEI	微博 (com.sina.weibo), v10.4.3 (4410)	Sina.com	10,000,000
IMSI	微博 (com.sina.weibo), v10.4.3 (4410)	Sina.com	10,000,000

Table 135 lists the 5 most popular Social apps that transmitted the most data types during the testing period, whereas Table 136 lists the 5 most popular Social apps that transmitted the fewest data types during the testing period.

Top 5 Apps	Developer	# of Installs	Data Types
Messenger for Messages,Chat,Video,Text,Call ID (messenger.chat.social.messenger), v3.19.0 (350)	Messenger Pro : Free Texts & Messages by AppyHigh	50,000,000	7
VK —live chatting & free calls (com.vkontakte.android), v6.2 (5112)	VK.com	100,000,000	6
SKOUT - Meet, Chat, Go Live (com.skout.android), v6.20.0 (1460)	Skout Inc.	50,000,000	6
Grindr - Gay chat (com.grindrapp.android), v6.9.0 (72428)	Grindr LLC	10,000,000	6
Messenger for Messages,Video Chat,Call ID for Free (messenger.chat.social.messenger.lite), v1.4.7 (147)	Messenger Pro : Free Texts & Messages by AppyHigh	10,000,000	6

Table 135: The top 5 Social apps that transmitted the most data types during testing.

Top 5 Apps	Developer	# of Installs	Data Types
Facebook (com.facebook.katana), v269.0.0.50.127 (212783074)	Facebook	5,000,000,000	0
Instagram (com.instagram.android), v140.0.0.30.126 (212676898)	Instagram	1,000,000,000	0
Telegram X (org.thunderdog.challegram), v0.22.6.1314-arm64-v8a (1314020)	Telegram LLC	10,000,000	0
MeWe (com.mewe), v6.2.4.0 (6240000)	MeWe	1,000,000	0
Friendly for Facebook (io.friendly), v4.4.07 (1103)	Friendly App Studio	1,000,000	0

Table 136: The top 5 Social apps that transmitted the fewest data types during testing.

D.6.2 App Permissions

Apps in the Social category requested the dangerous permissions listed in Table 137.¹³⁸

Data Type	# of Apps	(% of Apps)
WRITE_EXTERNAL_STORAGE	37	(90.2%)
READ_EXTERNAL_STORAGE	32	(78.0%)
ACCESS_COARSE_LOCATION	30	(73.2%)
CAMERA	29	(70.7%)
RECORD_AUDIO	28	(68.3%)
ACCESS_FINE_LOCATION	28	(68.3%)
READ_PHONE_STATE	26	(63.4%)
READ_CONTACTS	23	(56.1%)
GET_ACCOUNTS	19	(46.3%)
WRITE_CONTACTS	10	(24.4%)
CALL_PHONE	8	(19.5%)
READ_CALL_LOG	4	(9.8%)
WRITE_CALENDAR	4	(9.8%)
READ_CALENDAR	4	(9.8%)
ANSWER_PHONE_CALLS	3	(7.3%)
ACCESS_BACKGROUND_LOCATION	3	(7.3%)
SEND_SMS	1	(2.4%)
READ_PHONE_NUMBERS	1	(2.4%)
WRITE_CALL_LOG	1	(2.4%)
PROCESS_OUTGOING_CALLS	1	(2.4%)

Table 137: Dangerous permissions requested by apps in the Social category.

¹³⁸For an explanation of dangerous permissions, see Section 4.3.

D.6.2.1 Popular Apps Requesting Dangerous Permissions For each of these permissions, Table 138 lists the top 5 most popular apps that we observed requesting dangerous permissions during testing.¹³⁹

Table 138: The 5 most popular Social apps that requested each dangerous permission.

Permission	Top 5 Apps	Developer	# of Installs
WRITE_EXTERNAL_STORAGE	Facebook (com.facebook.katana), v269.0.0.50.127 (212783074)	Facebook	5,000,000,000
	TikTok - Make Your Day (com.zhiliaoapp.musically), v15.7.45 (2021507450)	TikTok Inc.	1,000,000,000
	Instagram (com.instagram.android), v140.0.0.30.126 (212676898)	Instagram	1,000,000,000
	Facebook Lite (com.facebook.lite), v197.1.0.17.125 (212922040)	Facebook	1,000,000,000
	Tumblr (com.tumblr), v15.9.0.01 (115090001)	Tumblr, Inc	100,000,000
READ_EXTERNAL_STORAGE	Facebook (com.facebook.katana), v269.0.0.50.127 (212783074)	Facebook	5,000,000,000
	TikTok - Make Your Day (com.zhiliaoapp.musically), v15.7.45 (2021507450)	TikTok Inc.	1,000,000,000
	Tumblr (com.tumblr), v15.9.0.01 (115090001)	Tumblr, Inc	100,000,000
	Badoo —Dating App to Chat, Date & Meet New People (com.badoo.mobile), v5.169.1 (3346)	Badoo	100,000,000
	Bigo Live - Live Stream, Live Video & Live Chat (sg.bigo.live), v4.34.4 (1703)	BIGO TECHNOLOGY PTE. LTD.	100,000,000
ACCESS_COARSE_LOCATION	Facebook (com.facebook.katana), v269.0.0.50.127 (212783074)	Facebook	5,000,000,000
	Facebook Lite (com.facebook.lite), v197.1.0.17.125 (212922040)	Facebook	1,000,000,000
	Tumblr (com.tumblr), v15.9.0.01 (115090001)	Tumblr, Inc	100,000,000
	Badoo —Dating App to Chat, Date & Meet New People (com.badoo.mobile), v5.169.1 (3346)	Badoo	100,000,000
	Bigo Live - Live Stream, Live Video & Live Chat (sg.bigo.live), v4.34.4 (1703)	BIGO TECHNOLOGY PTE. LTD.	100,000,000
CAMERA			

(Table Continues)

¹³⁹Popularity is determined by the number of reported installs in the Google Play Store.

Table 138 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	Facebook (com.facebook.katana), v269.0.0.50.127 (212783074)	Facebook	5,000,000,000
	TikTok - Make Your Day (com.zhiliaoapp.musically), v15.7.45 (2021507450)	TikTok Inc.	1,000,000,000
	Instagram (com.instagram.android), v140.0.0.30.126 (212676898)	Instagram	1,000,000,000
	Facebook Lite (com.facebook.lite), v197.1.0.17.125 (212922040)	Facebook	1,000,000,000
	Tumblr (com.tumblr), v15.9.0.01 (115090001)	Tumblr, Inc	100,000,000
RECORD_AUDIO			
	Facebook (com.facebook.katana), v269.0.0.50.127 (212783074)	Facebook	5,000,000,000
	TikTok - Make Your Day (com.zhiliaoapp.musically), v15.7.45 (2021507450)	TikTok Inc.	1,000,000,000
	Instagram (com.instagram.android), v140.0.0.30.126 (212676898)	Instagram	1,000,000,000
	Facebook Lite (com.facebook.lite), v197.1.0.17.125 (212922040)	Facebook	1,000,000,000
	Tumblr (com.tumblr), v15.9.0.01 (115090001)	Tumblr, Inc	100,000,000
ACCESS_FINE_LOCATION			
	Facebook (com.facebook.katana), v269.0.0.50.127 (212783074)	Facebook	5,000,000,000
	Instagram (com.instagram.android), v140.0.0.30.126 (212676898)	Instagram	1,000,000,000
	Facebook Lite (com.facebook.lite), v197.1.0.17.125 (212922040)	Facebook	1,000,000,000
	Badoo —Dating App to Chat, Date & Meet New People (com.badoo.mobile), v5.169.1 (3346)	Badoo	100,000,000
	VK —live chatting & free calls (com.vkontakte.android), v6.2 (5112)	VK.com	100,000,000
READ_PHONE_STATE			
	Facebook (com.facebook.katana), v269.0.0.50.127 (212783074)	Facebook	5,000,000,000
	Instagram (com.instagram.android), v140.0.0.30.126 (212676898)	Instagram	1,000,000,000
	Facebook Lite (com.facebook.lite), v197.1.0.17.125 (212922040)	Facebook	1,000,000,000
	Tumblr (com.tumblr), v15.9.0.01 (115090001)	Tumblr, Inc	100,000,000

(Table Continues)

Table 138 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(com.tumblr), v15.9.0.01 (115090001) Badoo —Dating App to Chat, Date & Meet New People (com.badoo.mobile), v5.169.1 (3346)	Badoo	100,000,000
READ_CONTACTS			
	Facebook (com.facebook.katana), v269.0.0.50.127 (212783074)	Facebook	5,000,000,000
	TikTok - Make Your Day (com.zhiliaoapp.musically), v15.7.45 (2021507450)	TikTok Inc.	1,000,000,000
	Instagram (com.instagram.android), v140.0.0.30.126 (212676898)	Instagram	1,000,000,000
	Facebook Lite (com.facebook.lite), v197.1.0.17.125 (212922040)	Facebook	1,000,000,000
	Tumblr (com.tumblr), v15.9.0.01 (115090001)	Tumblr, Inc	100,000,000
GET_ACCOUNTS			
	Facebook (com.facebook.katana), v269.0.0.50.127 (212783074)	Facebook	5,000,000,000
	Instagram (com.instagram.android), v140.0.0.30.126 (212676898)	Instagram	1,000,000,000
	Facebook Lite (com.facebook.lite), v197.1.0.17.125 (212922040)	Facebook	1,000,000,000
	Tumblr (com.tumblr), v15.9.0.01 (115090001)	Tumblr, Inc	100,000,000
	Badoo —Dating App to Chat, Date & Meet New People (com.badoo.mobile), v5.169.1 (3346)	Badoo	100,000,000
WRITE_CONTACTS			
	Facebook (com.facebook.katana), v269.0.0.50.127 (212783074)	Facebook	5,000,000,000
	Facebook Lite (com.facebook.lite), v197.1.0.17.125 (212922040)	Facebook	1,000,000,000
	VK —live chatting & free calls (com.vkontakte.android), v6.2 (5112)	VK.com	100,000,000
	Messenger for Messages,Chat,Video,Text,Call ID (messenger.chat.social.messenger), v3.19.0 (350)	Messenger Pro : Free Texts & Messages by AppyHigh	50,000,000
	Messenger (messenger.social.chat.apps), v1.3.3 (133)	Text Free & Free Call & SMS & MMS & Messenger Team	10,000,000
CALL_PHONE			
	Facebook Lite (com.facebook.lite), v197.1.0.17.125 (212922040)	Facebook	1,000,000,000
	Messenger for Messages,Chat,Video,Text,Call ID (Table Continues)	Messenger Pro : Free Texts & Messages by AppyHigh	50,000,000

Table 138 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(messenger.chat.social.messenger), v3.19.0 (350)		
	Messenger	Text Free & Free Call & SMS & MMS & Messenger Team	10,000,000
	(messenger.social.chat.apps), v1.3.3 (133)		
	네이버카페 - Naver Cafe	NAVER Corp.	10,000,000
	(com.nhn.android.navercafe), v4.13.0.3 (19000039)		
	Messenger for Messages,Video Chat,Call ID for Free	Messenger Pro : Free Texts & Messages by AppyHigh	10,000,000
	(messenger.chat.social.messenger.life), v1.4.7 (147)		
READ_CALL_LOG			
	VK —live chatting & free calls		
	(com.vkontakte.android), v6.2 (5112)	VK.com	100,000,000
	Messenger for Messages,Chat,Video,Text,Call ID	Messenger Pro : Free Texts & Messages by AppyHigh	50,000,000
	(messenger.chat.social.messenger), v3.19.0 (350)		
	The Fast Video Messenger App for Video Calling	Messenger Family: Free messenger & live video chat	5,000,000
	(messenger.messenger.videocall.messenger), v3.2.10 (139)		
	TextFun : Free Texting & Calling	SMS Messenger	1,000,000
	(com.textfun.text.free.call), v2.0.6 (206)		
WRITE_CALENDAR			
	Facebook	Facebook	5,000,000,000
	(com.facebook.katana), v269.0.0.50.127 (212783074)		
	Facebook Lite	Facebook	1,000,000,000
	(com.facebook.lite), v197.1.0.17.125 (212922040)		
	微博	Sina.com	10,000,000
	(com.sina.weibo), v10.4.3 (4410)		
	Oasis Dating - 100% Free Chat	3HGroupPtyLtd	500,000
	(com.oasis.wrapper), v2.0.840[0..8] (840)		
READ_CALENDAR			
	Facebook	Facebook	5,000,000,000
	(com.facebook.katana), v269.0.0.50.127 (212783074)		
	Facebook Lite	Facebook	1,000,000,000
	(com.facebook.lite), v197.1.0.17.125 (212922040)		
	微博	Sina.com	10,000,000
	(com.sina.weibo), v10.4.3 (4410)		
	Oasis Dating - 100% Free Chat	3HGroupPtyLtd	500,000
	(com.oasis.wrapper), v2.0.840[0..8] (840)		
ANSWER_PHONE_CALLS			
	Messenger for Messages,Chat,Video,Text,Call ID	Messenger Pro : Free Texts & Messages by AppyHigh	50,000,000
	(messenger.chat.social.messenger), v3.19.0 (350)		
	Messenger for Messages,Video Chat,Call ID for Free	Messenger Pro : Free Texts & Messages by AppyHigh	10,000,000
	(messenger.chat.social.messenger.life), v1.4.7 (147)		
	The Fast Video Messenger App for Video Calling	Messenger Family: Free messenger & live video chat	5,000,000
	(Table Continues)		

Table 138 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(messenger.messenger.videocall.messenger), v3.2.10 (139)		
ACCESS_BACKGROUND_LOCATION			
	Messenger for Messages,Chat,Video,Text,Call ID (messenger.chat.social.messenger), v3.19.0 (350)	Messenger Pro : Free Texts & Messages by AppyHigh	50,000,000
	Messenger for Messages,Video Chat,Call ID for Free (messenger.chat.social.messenger.life), v1.4.7 (147)	Messenger Pro : Free Texts & Messages by AppyHigh	10,000,000
	Messenger App for Free Video messages, Video Calls (messenger.video.call.chat.free), v1.3.6 (37)	Messenger Pro : Free Texts & Messages by AppyHigh	1,000,000
SEND_SMS			
	Messenger for Messages,Chat,Video,Text,Call ID (messenger.chat.social.messenger), v3.19.0 (350)	Messenger Pro : Free Texts & Messages by AppyHigh	50,000,000
READ_PHONE_NUMBERS			
	VK —live chatting & free calls (com.vkontakte.android), v6.2 (5112)	VK.com	100,000,000
WRITE_CALL_LOG			
	TextFun : Free Texting & Calling (com.textfun.text.free.call), v2.0.6 (206)	SMS Messenger	1,000,000
PROCESS_OUTGOING_CALLS			
	TextFun : Free Texting & Calling (com.textfun.text.free.call), v2.0.6 (206)	SMS Messenger	1,000,000

Table 139 lists the 5 most popular Social apps that requested the most permissions, whereas Table 140 lists the 5 most popular Social apps that requested the fewest permissions.

Top 5 Apps	Developer	# of Installs	Permissions
微博 (com.sina.weibo), v10.4.3 (4410)	Sina.com	10,000,000	48
TextFun : Free Texting & Calling (com.textfun.text.free.call), v2.0.6 (206)	SMS Messenger	1,000,000	43
Facebook (com.facebook.katana), v269.0.0.50.127 (212783074)	Facebook	5,000,000,000	34
VK —live chatting & free calls (com.vkontakte.android), v6.2 (5112)	VK.com	100,000,000	32
Bigo Live - Live Stream, Live Video & Live Chat (sg.bigo.live), v4.34.4 (1703)	BIGO TECHNOLOGY PTE. LTD.	100,000,000	30

Table 139: The 5 most popular Social apps that requested the most permissions.

Top 5 Apps	Developer	# of Installs	Permissions
Messengers for Collection Social (free.group.chat.social.messenger), v26.0 (26)	messagedevteam	1,000,000	3
Social detective (com.social.detective), v20 (20)	Profile detective tools	500,000	4
Mimi 4chan Reader (com.emogoth.android.phone.mimi), v6.0.4 (220)	Mimi Reader	1,000,000	5
BlindStory - Watch, Download Stories for Instagram (com.storystalker.forinstagram), v1.0.15 (15)	Easypeek	50,000	6
IMVU - Game with 3D Avatars, Chat and Real Friends (com.imvu.mobilecordova), v5.3.2.50302006 (50302006)	IMVU, Inc.	10,000,000	12

Table 140: The 5 most popular Social apps that requested the least number of permissions.

D.6.2.2 Permission Usage While the previous subsection depicted the dangerous permissions *requested* by the apps that were tested, Table 141 lists the Social apps based on the dangerous permissions that were observed being *used* during the testing period.

Table 141: Social apps based on total number of permissions requested, the number of those that are considered “dangerous,” and the percentage of those dangerous permissions that were used during testing.

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
微博 (com.sina.weibo), v10.4.3 (4410)	Sina.com	48	12	8.3
TextFun : Free Texting & Calling (com.textfun.text.free.call), v2.0.6 (206)	SMS Messenger	43	10	0.0
Facebook (com.facebook.katana), v269.0.0.50.127 (212783074)	Facebook	34	12	25.0
VK —live chatting & free calls (com.vkontakte.android), v6.2 (5112)	VK.com	32	12	41.7
Bigo Live - Live Stream, Live Video & Live Chat (sg.bigo.live), v4.34.4 (1703)	BIGO TECHNOLOGY PTE. LTD.	30	8	12.5
Facebook Lite (com.facebook.lite), v197.1.0.17.125 (212922040)	Facebook	29	12	0.0
Telegram X (org.thunderdog.challegram), v0.22.6.1314-arm64-v8a (1314020)	Telegram LLC	27	9	11.1
The Fast Video Messenger App for Video Calling (messenger.messenger.videocall.messenger), v3.2.10 (139)	Messenger Family: Free messenger & live video chat	27	12	33.3
Messenger App for Free Video messages, Video Calls (messenger.video.call.chat.free), v1.3.6 (37)	Messenger Pro : Free Texts & Messages by AppyHigh	26	9	0.0
PortSIP Softphone (com.portgo), v9.5.1 (951)	PortSIP	26	6	0.0
Badoo —Dating App to Chat, Date & Meet New People (com.badoo.mobile), v5.169.1 (3346)	Badoo	26	8	12.5
TikTok - Make Your Day (com.zhiliaoapp.musically), v15.7.45 (2021507450)	TikTok Inc.	24	5	20.0
Tagged - Meet, Chat & Dating (com.taggedapp), v9.25.1 (1366)	Ifwe Inc.	23	9	0.0
hi5 - meet, chat & flirt (com.hi5.app), v9.26.0 (1374)	Ifwe Inc.	23	9	22.2
Messenger for Messages,Video Chat,Call ID for Free (messenger.chat.social.messenger.lite), v1.4.7 (147)	Messenger Pro : Free Texts & Messages by AppyHigh	23	12	25.0
Messenger for Messages,Chat,Video,Text,Call ID (Table Continued)	Messenger Pro : Free Texts & Messages by AppyHigh	23	13	38.5

Table 141 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(messenger.chat.social.messenger), v3.19.0 (350)				
Tumblr (com.tumblr), v15.9.0.01 (115090001)	Tumblr, Inc	22	8	0.0
Grindr - Gay chat (com.grindrapp.android), v6.9.0 (72428)	Grindr LLC	22	6	16.7
Messenger (messenger.social.chat.apps), v1.3.3 (133)	Text Free & Free Call & SMS & MMS & Messenger Team	21	4	0.0
MeetMe: Chat & Meet New People (com.myearbook.m), v14.12.6.2535 (2535)	MeetMe.com	21	7	42.9
Houseparty (com.herzick.houseparty), v1.41.1 (48682)	Life on Air	20	6	0.0
Instagram (com.instagram.android), v140.0.0.30.126 (212676898)	Instagram	19	7	0.0
Wickr Me -Private Messenger (com.mywickr.wickr2), v5.53.8 (5530813)	Wickr Inc	19	8	0.0
Oasis Dating - 100% Free Chat (com.oasis.wrapper), v2.0.840[0..8] (840)	3HGroupPtyLtd	19	8	25.0
Plenty of Fish Free Dating App (com.pof.android), v4.16.0.1419827 (1419827)	Plentyoffish Media ULC	18	8	0.0
MeWe (com.mewe), v6.2.4.0 (6240000)	MeWe	18	8	0.0
네이버카페 - Naver Cafe (com.nhn.android.navercafe), v4.13.0.3 (19000039)	NAVER Corp.	18	8	0.0
SKOUT - Meet, Chat, Go Live (com.skout.android), v6.20.0 (1460)	Skout Inc.	17	8	25.0
Amino: Communities and Chats (com.narvi.amino.master), v3.3.33204 (33204)	Amino Apps	16	9	0.0
Tellonym: Honest Q&A (de.tellonym.app), v2.41.2 (300)	Callosum Software	16	6	16.7
Yubo: Make New Friends - Meet & Chat Livestream (co.yellw.yellowapp), v3.109.0 (20017379)	Twelve APP	15	6	16.7
더시인사이드 - dcinside (com.dcinside.app), v3.8.2 (30201)	dcinside	14	4	0.0
Sikh World (com.khushwant.sikhworld), v30.2 (211)	Khushwant Singh	14	5	0.0
SCRUFF (com.appspot.scruffapp), v6.1802 (10398)	Perry Street Software	14	5	40.0
Friendly for Facebook	Friendly App Studio	13	3	0.0

(Table Continues)

Table 141 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(io.friendly), v4.4.07 (1103)				
Dark Social (org.nightmode.dark.social), v1.2.3 (108)	Night Mode Labs	13	3	0.0
IMVU - Game with 3D Avatars, Chat and Real Friends (com.imvu.mobilecordova), v5.3.2.50302006 (50302006)	IMVU, Inc.	12	3	0.0
BlindStory - Watch, Download Stories for Instagram (com.storystalker.forinstagram), v1.0.15 (15)	Easypeek	6	2	0.0
Mimi 4chan Reader (com.emogoth.android.phone.mimi), v6.0.4 (220)	Mimi Reader	5	2	0.0
Social detective (com.social.detective), v20 (20)	Profile detective tools	4	0	0.0
Messengers for Collection Social (free.group.chat.social.messenger), v26.0 (26)	messagedevteam	3	0	0.0

D.6.3 Third-Party SDKs

We were able to identify 171 SDKs embedded within the 41 Social apps. We list the 40 most common SDKs in Table 142,¹⁴⁰ along with the number of Social apps in which they were detected.

Table 142: The 40 most common SDKs identified within apps in the Social category.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	39	(95.1%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	39	(95.1%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	33	(80.5%)
Google Gson	Google	Development Aid	32	(78.0%)
Google Play	Google Play	App Market	25	(61.0%)
Facebook Login	Facebook	Digital Identify Advertisement Mobile Analytics	24	(58.5%)
Facebook Share	Facebook	Social Network Advertisement Mobile Analytics	24	(58.5%)
Crashlytics	Google	Mobile Analytics	24	(58.5%)
Facebook Analytics	Facebook	Mobile Analytics	23	(56.1%)
Google Ads	Google	Advertisement	23	(56.1%)
ZXing ('Zebra Crossing')	ZXing Project	Development Aid	23	(56.1%)
Facebook Ads	Facebook	Advertisement	22	(53.7%)
Glide	Bump Technologies	Development Aid	20	(48.8%)

(Table Continues)

¹⁴⁰For an explanation of SDKs, see Section 4.1.2.

Table 142 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google DoubleClick	Google	Advertisement	20	(48.8%)
picasso	Square Inc.	Development Aid	19	(46.3%)
Github	Github	Development Aid	18	(43.9%)
Fasterxml	FasterXML	Utility	17	(41.5%)
Moat	Oracle	Mobile Analytics	17	(41.5%)
Facebook Places	Facebook	Map/LBS Advertisement	17	(41.5%)
MoPub	Twitter	Advertisement	15	(36.6%)
Google Core Libraries for Java 6+	Google	Development Aid	14	(34.1%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	12	(29.3%)
Volley HTTP library	Google	Development Aid Networking	11	(26.8%)
Integral Ad Science	Integral Ad Science Inc.	Mobile Analytics Advertisement AdFraud	11	(26.8%)
Inmobi	InMobi	Advertisement	10	(24.4%)
Smaato	Smaato	Advertisement LBS	10	(24.4%)
Google Analytics	Google	Mobile Analytics	9	(22.0%)
getui	getui	Advertisement Mobile Analytics Push Notifications	9	(22.0%)
Apache Common	The Apache Software Founda- tion	Development Aid	9	(22.0%)
YouTube Android Player API	Google	Development Aid	9	(22.0%)
Google Protocol Buffers	Google	Development Aid	9	(22.0%)
Vungle	Vungle	Advertisement	9	(22.0%)
JavaX Annotation API	JavaX Annotation API	Utility	9	(22.0%)
Unity3D	Unity Technologies	Game Engine	9	(22.0%)

(Table Continues)

Table 142 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
		Mobile Analytics Advertisement		
Jsoup	Jsoup	Development Aid	9	(22.0%)
AdColony	AdColony	Advertisement	8	(19.5%)
Amazon Advertisement	Amazon	Advertisement	8	(19.5%)
Applovin	AppLovin	Advertisement	8	(19.5%)
Google Tag Manager	Google	Mobile Analytics	7	(17.1%)
Google Internationalization	Google	Development Aid	7	(17.1%)

Several of these SDKs included developer tools, which we characterize as SDKs that provide tools and functionality to app developers which are unlikely to be used for the transmission of user information. As a result, we separately present Table 143, which depicts the 40 most common SDKs with developer tools removed, along with the number of Social apps in which they were detected.

Table 143: The 40 most common SDKs identified within apps in the Social category, with developer tools removed.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	39	(95.1%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	39	(95.1%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	33	(80.5%)
Google Play	Google Play	App Market	25	(61.0%)

(Table Continues)

Table 143 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Facebook Login	Facebook	Digital Identity Advertisement Mobile Analytics	24	(58.5%)
Facebook Share	Facebook	Social Network Advertisement Mobile Analytics	24	(58.5%)
Crashlytics	Google	Mobile Analytics	24	(58.5%)
Facebook Analytics	Facebook	Mobile Analytics	23	(56.1%)
Google Ads	Google	Advertisement	23	(56.1%)
Facebook Ads	Facebook	Advertisement	22	(53.7%)
Google DoubleClick	Google	Advertisement	20	(48.8%)
Moat	Oracle	Mobile Analytics	17	(41.5%)
Facebook Places	Facebook	Map/LBS Advertisement	17	(41.5%)
MoPub	Twitter	Advertisement	15	(36.6%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	12	(29.3%)
Volley HTTP library	Google	Development Aid Networking	11	(26.8%)
Integral Ad Science	Integral Ad Science Inc.	Mobile Analytics Advertisement AdFraud	11	(26.8%)
Inmobi	InMobi	Advertisement	10	(24.4%)
Smaato	Smaato	Advertisement LBS	10	(24.4%)
Google Analytics	Google	Mobile Analytics	9	(22.0%)
getui	getui	Advertisement Mobile Analytics Push Notifications	9	(22.0%)
Vungle	Vungle	Advertisement	9	(22.0%)
Unity3D	Unity Technologies	Game Engine	9	(22.0%)

(Table Continues)

Table 143 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
		Mobile Analytics Advertisement		
AdColony	AdColony	Advertisement	8	(19.5%)
Amazon Advertisement	Amazon	Advertisement	8	(19.5%)
AppLovin	AppLovin	Advertisement	8	(19.5%)
Google Tag Manager	Google	Mobile Analytics	7	(17.1%)
Flurry	Verizon	Mobile Analytics	7	(17.1%)
Fyber	Fyber	Advertisement	7	(17.1%)
IronSource	IronSource	Advertisement Mobile Analytics	7	(17.1%)
Inneractive	Fyber	Advertisement	6	(14.6%)
adjust	Adjust	Mobile Analytics Advertisement	5	(12.2%)
AerServ	InMobi	Mobile Analytics	5	(12.2%)
Criteo	Criteo	Advertisement	5	(12.2%)
HyprMX	HyprMX	Advertisement	5	(12.2%)
Parse.com	Parse	Mobile Analytics Development Aid	5	(12.2%)
Unity3d Ads	Unity Technologies	Advertisement	5	(12.2%)
millennialmedia	Verizon	Advertisement	4	(9.8%)
CallDorado	CallDorado	Mobile Analytics User engagement	4	(9.8%)
Tencent Wechat	Tencent	Social Network	4	(9.8%)

D.7 Personalization Apps

D.7.1 Data Types Transmitted

Apps in the Personalization category were observed transmitting the data types listed in Table 144 during the testing period.¹⁴¹

Data Type	# of Apps	(% of Apps)
AAID	18	(43.9%)
Android ID	14	(34.1%)
WiFi MAC	6	(14.6%)
Coarse Location	6	(14.6%)
GPS Location	5	(12.2%)
IMEI	4	(9.8%)
Serial #	4	(9.8%)
IMSI	1	(2.4%)
BT Name	1	(2.4%)

Table 144: Data types transmitted by apps in the Personalization category during the testing period.

¹⁴¹For an explanation of these data types, see Section 3.

D.7.1.1 Most Common Hostnames Contacted

Table 145 depicts the top 10 hostnames observed being contacted by Personalization apps during the testing period, whereas Table 146 depicts the top 10 parent companies corresponding to these hostnames. This data reflects Internet servers that were *contacted* by apps, but does not necessarily mean that they received sensitive user information—we specifically discuss that subset of recipients in Section D.7.1.2.¹⁴² The discrepancy between the two sections is due to the fact that some app transmissions may simply not contain sensitive user information or that its transmission was obfuscated using a method that we did not immediately recognize.

Hostname	Parent Company	# of Apps	(% of Apps)
googleads.g.doubleclick.net	Google	17	(41.5%)
settings.crashlytics.com	Google	16	(39.0%)
graph.facebook.com	Facebook	12	(29.3%)
pagead2.googleadservices.com	Google	11	(26.8%)
tpc.google syndication.com	Google	10	(24.4%)
www.googletagservices.com	Google	9	(22.0%)
pagead2.google syndication.com	Google	9	(22.0%)
lh3.googleusercontent.com	Google	9	(22.0%)
fonts.googleapis.com	Google	9	(22.0%)
www.gstatic.com	Google	9	(22.0%)

Table 145: The top 10 most common hostnames contacted by Personalization apps during testing.

Company	# of Apps	(% of Apps)
Google	30	(73.2%)
Facebook	12	(29.3%)
AppsFlyer	7	(17.1%)
Tencent	5	(12.2%)
Yandex	5	(12.2%)
Alibaba	5	(12.2%)
Twitter	5	(12.2%)
CNN	4	(9.8%)
Amber Weather	4	(9.8%)
Smaato	4	(9.8%)

¹⁴²We define “user information” in Section 3.

Company	# of Apps	(% of Apps)
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Table 146: The top 10 most common companies contacted by Personalization apps during testing.

D.7.1.2 Most Common Data Recipients

Table 147 depicts the top 10 data recipients among the Personalization apps during the testing period. Table 148 lists additional information about the most common data recipients, such as the approximate locations of their servers, IP addresses contacted during testing, and the types of sensitive user information that we observed them receive during the testing period.

Hostname	Parent Company	# of Apps	(% of Apps)
graph.facebook.com	Facebook	12	(29.3%)
t.appsflyer.com	AppsFlyer	7	(17.1%)
alog.umeng.com	Alibaba	4	(9.8%)
aqi.wd.amberweather.com	Amber Weather	4	(9.8%)
sdk-android.ad.smaato.net	Smaato	4	(9.8%)
ads.mopub.com	Twitter	4	(9.8%)
w.ws.amberweather.com	Amber Weather	4	(9.8%)
api.mediation.amberweather.com	Amber Weather	4	(9.8%)
f.loca.amberweather.com	Amber Weather	4	(9.8%)
events.appsflyer.com	AppsFlyer	3	(7.3%)

Table 147: The top 10 most common data recipients from Personalization apps during testing.

Table 148: The 10 most common recipient hostnames of user information from Personalization apps during the testing period, along with their IP addresses, company information, and the data types that were observed being transmitted.

Parent Company	Country	IPs	Received Data
<i>graph.facebook.com</i>			
Facebook	United States	157.240.8.18 (US) 31.13.70.1 (US)	Android ID Coarse Location AAID
<i>t.appsflyer.com</i>			
AppsFlyer	United States	34.250.113.5 (IE) 52.49.215.65 (IE) 52.17.107.26 (IE) 54.229.202.84 (IE) 54.154.116.86 (IE) 54.229.245.170 (IE) 18.203.117.12 (IE)	Android ID AAID
<i>alog.umeng.com</i>			
Alibaba	China	106.11.86.70 (CN) 203.119.128.118 (CN) 203.119.211.230 (CN) 203.119.129.77 (CN)	Android ID Serial # WIFI MAC IMEI AAID
<i>f.loca.amberweather.com</i>			
Amber Weather	Hong Kong	54.95.40.207 (JP) 52.68.30.94 (JP)	Android ID GPS Location Coarse Location IMSI
<i>aqi.wd.amberweather.com</i>			
Amber Weather	Hong Kong	54.250.210.243 (JP) 3.114.102.243 (JP)	GPS Location Coarse Location Android ID
<i>ads.mopub.com</i>			
Twitter	United States	192.48.236.11 (US) 192.48.236.12 (US) 192.48.236.10 (US)	GPS Location Coarse Location AAID

(Table Continues)

Table 148 (Continued)

Parent Company	Country	IPs	Received Data
w.ws.amberweather.com			
Amber Weather	Hong Kong	52.197.18.246 (JP) 54.199.225.247 (JP)	GPS Location Coarse Location Android ID
sdk-android.ad.smaato.net			
Smaato	United States	13.251.5.168 (SG) 52.74.252.114 (SG) 18.140.19.140 (SG)	AAID Coarse Location
api.mediation.amberweather.com			
Amber Weather	Hong Kong	13.113.160.216 (JP) 18.181.153.215 (JP)	Android ID
events.appsflyer.com			
AppsFlyer	United States	52.30.251.152 (IE) 52.211.143.213 (IE) 52.209.89.148 (IE)	Android ID AAID

D.7.1.3 Apps Ranked by Number of Recipients

Table 149 ranks the Personalization apps based on the number of recipients to which we detected each transmit sensitive user information during testing.

Table 149: Personalization apps ordered by the number of recipients (by unique hostnames and their parent companies) during the testing period.

App	Developer	Installs	Recipients	
			Hostnames	Companies
iLauncher OS13-Phone X style Package Name: com.amber.launcher.ios.iphonex.apple.os13 Version: 4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	1,000,000	21	11
Galaxy S10 Launcher for Samsung Package Name: com.amber.launcher.samsung.s10.galaxy.s9.s10lite Version: 4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	1,000,000	18	10
Electric Screen for Prank Live Wallpaper & Launcher Package Name: mobi.infolife.ezweather.livewallpaper.g2n19 Version: 4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	10,000,000	15	8
Apex Launcher - Customize,Secure,and Efficient Package Name: com.anddoes.launcher Version: 4.9.11 (6093)	Android Does Team	10,000,000	9	6
Function - Easy Email Inbox & Productivity Tools Package Name: com.myhomescreen.email Version: 2.7.34 (1575)	Yobi Mobi	1,000,000	7	6
News Home - Full Screen News Widget and Launcher Package Name: com.myhomescreen.news Version: 2.6.21 (3340)	Yobi Mobi	1,000,000	6	5
Parallel Space - Multiple accounts & Two face Package Name: com.lbe.parallel.intl Version: 4.0.8934 (10820)	LBE Tech	100,000,000	8	4
GO Launcher - 3D parallax Themes & HD Wallpapers Package Name: com.gau.go.launcherex Version: 3.24 (739)	GOMO Live	100,000,000	22	4
DIY color keyboard Package Name: com.diy.keyboard Version: 1.4.5 (2981)	Paredes BLACKGOAT	1,000,000	5	3
Super 3D Wallpapers - Super realistic 3D effects Package Name: com.super.wallpapers.seat Version: 1.5.6 (156)	Seat Wallpapers Labs	100,000	5	3
Smart Launcher 5 Package Name: ginlemon.flowerfree Version: 5.4 build 034 (1646)	Smart Launcher Team	10,000,000	2	2

(Table Continues)

Table 149 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Microsoft Launcher Package Name: com.microsoft.launcher Version: 5.11.5.56362 (56362)	Microsoft Corporation	10,000,000	7	2
Evie Launcher Package Name: is.shortcut Version: 2.14.8-9 (21408009)	Evie Labs Inc.	5,000,000	2	2
Magic cleaner PRO Package Name: pro.magic.cleaner.boost Version: 1.45 (45)	Utility App Studio	500,000	4	2
Galaxy Wild Wolf Keyboard Theme Package Name: com.ikeyboard.theme.galaxy.wild.wolf Version: 1.0 (30)	Free keyboard for Android-2020 theme apps	500,000	2	2
Stylish –Customize Your Navbar & Weather Widget Package Name: com.stylish.stylebar Version: 1.0.485 (10485)	Stylish for Android	100,000	3	2
Fast Typing Keyboard Package Name: com.jb.gokeyboard.theme.timssfasttypingkeyboard Version: 1.275.18.131 (131)	Launcher 2020 - Themes & Keyboard Apps	10,000,000	1	1
Muviz –Navbar Music Visualizer Package Name: com.perfectapps.muviz Version: 5.0.5.0 (119)	Sparkine Labs	1,000,000	1	1
NavBar Animations (No Root) Package Name: com.axndx.navbaranimations Version: 3.0.4 (17)	axndx	500,000	1	1
Edge Screen - Edge Gesture, Edge Action Package Name: com.edgescreen.edgeaction Version: 2.3.0 (147)	Edge Action Studio	500,000	2	1
Nova Launcher Package Name: com.teslacoilsw.launcher Version: 6.2.12 (62012)	TeslaCoil Software	50,000,000	0	0
Theme Store Package Name: com.nearme.themestore Version: 7.0.0 (7005)	OPPO ColorOS	50,000,000	0	0
POCO Launcher 2.0 - Customize, Fresh & Clean Package Name: com.mi.android.globallauncher Version: 2.7.4.4 (2070404)	Xiaomi Inc.	10,000,000	0	0
LED Keyboard Lighting - Mechanical Keyboard RGB Package Name: com.flashkeyboard.leds Version: 5.8.37 (101)	Zayzik Studio	10,000,000	0	0
Square Home 3 - Launcher : Windows style Package Name: com.ss.squarehome2	ChYK the dev.	5,000,000	0	0

(Table Continues)

Table 149 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Version: 2.0.5 (20005) Action Launcher: Pixel Edition Package Name: com.actionlauncher.playstore Version: 45.0 (45000500)	Action Launcher	5,000,000	0	0
Bottom Quick Settings - Notification Customization Package Name: com.tombayley.bottomquicksettings Version: 6.1.4 (248)	Tom Bayley	1,000,000	0	0
Control Center iOS 13 - Screen Recorder Package Name: com.tuanfadbg.controlcenterios Version: 2.6.9.13.11 (119)	FA developer	1,000,000	0	0
Lawnchair 2 Package Name: ch.deletescape.lawnchair.plah Version: 2.0-2589 (2589)	deletescape	1,000,000	0	0
Always On Edge - Edge Lighting □ Package Name: com.used.aoe Version: 5.8.1 (2358101)	Alrbea Ent.	1,000,000	0	0
Power Shade: Notification Panel & Quick Settings Package Name: com.treydev.pns Version: 15.71 (1571000)	Treydev Inc	1,000,000	0	0
NotifyBuddy - AMOLED Notification Light Package Name: com.xander.android.notifybuddy Version: 1.81 (89)	XanderApps	1,000,000	0	0
Black Hole - Lock screen Package Name: ginlemon.locker.blackHole Version: 5.4.24 (89)	Smart Launcher Team	1,000,000	0	0
Energy Ring - Galaxy S10/e/5G/+ battery indicator! Package Name: you.in.spark.energy.ring Version: ER_BETA_7.12 (32)	IJP	500,000	0	0
hyperion launcher Package Name: projekt.launcher Version: fifty two (52)	prijkt.io	500,000	0	0
Energy Ring - Note 10/5G/Lite/+ battery indicator! Package Name: you.in.spark.energy.ring.note Version: ER_NOTE10_1.3 (4)	IJP	100,000	0	0
Battery Screen Saver - Customizable Daydream Package Name: com.zas.batteryscreensaver Version: 1.4.3.4 (16)	Zas	100,000	0	0
Muviz Edge - Music Visualizer, Edge Music Lighting Package Name: com.sparkine.muvizedge Version: 1.1.3.0 (26)	Sparkine Labs	100,000	0	0
Custom AOD (Add images on Always On Display)	Dhwani developer (Table Continues)	100,000	0	0

Table 149 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Package Name: com.somen.customaod Version: 3.0.7 Beta (29)				
Minimalist launcher for focus Before Launcher Package Name: com.beforesoft.launcher Version: 3.0.1 (255)	Before Labs	100,000	0	0
Pear Launcher Package Name: com.pearlauncher.pearlauncher Version: 2.0.9 (92)	Yajat Kumar	100,000	0	0

D.7.1.4 Popular Apps Transmitting Each Data Type

For each of these data types, Table 150 lists the top 5 most popular Personalization apps that we observed transmitting them during testing.¹⁴³

Table 150: The top 5 Personalization apps that we detected transmitting each data type during the testing period.

Data Type	Top 5 Apps	Developer	# of Installs
AAID	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
	GO Launcher - 3D parallax Themes & HD Wallpapers (com.gau.go.launcherex), v3.24 (739)	GOMO Live	100,000,000
	Smart Launcher 5 (ginlemon.flowerfree), v5.4 build 034 (1646)	Smart Launcher Team	10,000,000
	Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000
	Apex Launcher - Customize,Secure,and Efficient (com.anddoes.launcher), v4.9.11 (6093)	Android Does Team	10,000,000
Android ID	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
	GO Launcher - 3D parallax Themes & HD Wallpapers (com.gau.go.launcherex), v3.24 (739)	GOMO Live	100,000,000
	Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000
	Apex Launcher - Customize,Secure,and Efficient (com.anddoes.launcher), v4.9.11 (6093)	Android Does Team	10,000,000
	Electric Screen for Prank Live Wallpaper & Launcher (mobi.infolife.ezweather.livewallpaper.g2n19), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	10,000,000
WiFi MAC	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
	Apex Launcher - Customize,Secure,and Efficient (com.anddoes.launcher), v4.9.11 (6093)	Android Does Team	10,000,000
	Electric Screen for Prank Live Wallpaper & Launcher (mobi.infolife.ezweather.livewallpaper.g2n19), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	10,000,000
	iLauncher OS13-Phone X style (com.amber.launcher.ios.iphonex.apple.os11), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	1,000,000

(Table Continues)

¹⁴³Popularity is determined by the number of reported installs in the Google Play Store.

Table 150 (Continued)

Data Type	Top 5 Apps	Developer	# of Installs
	Galaxy S10 Launcher for Samsung (com.amber.launcher.samsung.s10.galaxy.s9.s8.s10lite), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	1,000,000
	Coarse Location		
	Smart Launcher 5 (ginlemon.flowerfree), v5.4 build 034 (1646)	Smart Launcher Team	10,000,000
	Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000
	Apex Launcher - Customize,Secure,and Efficient (com.anddoes.launcher), v4.9.11 (6093)	Android Does Team	10,000,000
	Electric Screen for Prank Live Wallpaper & Launcher (mobi.infolife.ezweather.livewallpaper.g2n19), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	10,000,000
	iLauncher OS13-Phone X style (com.amber.launcher.ios.iphonex.apple.os11), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	1,000,000
	GPS Location		
	Smart Launcher 5 (ginlemon.flowerfree), v5.4 build 034 (1646)	Smart Launcher Team	10,000,000
	Apex Launcher - Customize,Secure,and Efficient (com.anddoes.launcher), v4.9.11 (6093)	Android Does Team	10,000,000
	Electric Screen for Prank Live Wallpaper & Launcher (mobi.infolife.ezweather.livewallpaper.g2n19), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	10,000,000
	iLauncher OS13-Phone X style (com.amber.launcher.ios.iphonex.apple.os11), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	1,000,000
	Galaxy S10 Launcher for Samsung (com.amber.launcher.samsung.s10.galaxy.s9.s8.s10lite), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	1,000,000
	IMEI		
	Apex Launcher - Customize,Secure,and Efficient (com.anddoes.launcher), v4.9.11 (6093)	Android Does Team	10,000,000
	Electric Screen for Prank Live Wallpaper & Launcher (mobi.infolife.ezweather.livewallpaper.g2n19), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	10,000,000
	iLauncher OS13-Phone X style (com.amber.launcher.ios.iphonex.apple.os11), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	1,000,000
	Galaxy S10 Launcher for Samsung (com.amber.launcher.samsung.s10.galaxy.s9.s8.s10lite), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	1,000,000

(Table Continues)

Table 150 (Continued)

Data Type	Top 5 Apps	Developer	# of Installs
Serial #	Apex Launcher - Customize,Secure,and Efficient (com.anddoes.launcher), v4.9.11 (6093)	Android Does Team	10,000,000
	Electric Screen for Prank Live Wallpaper & Launcher (mobi.infolife.ezweather.livewallpaper.g2n19), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	10,000,000
	iLauncher OS13-Phone X style (com.amber.launcher.ios.iphonex.apple.os11), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	1,000,000
	Galaxy S10 Launcher for Samsung (com.amber.launcher.samsung.s10.galaxy.s9.s8.s10lite), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	1,000,000
IMSI	Apex Launcher - Customize,Secure,and Efficient (com.anddoes.launcher), v4.9.11 (6093)	Android Does Team	10,000,000
BT Name	Super 3D Wallpapers - Super realistic 3D effects (com.super.wallpapers.seat), v1.5.6 (156)	Seat Wallpapers Labs	100,000

Table 151 lists the 5 most popular Personalization apps that transmitted the most data types during the testing period, whereas Table 152 lists the 5 most popular Personalization apps that transmitted the fewest data types during the testing period.

Top 5 Apps	Developer	# of Installs	Data Types
Apex Launcher - Customize,Secure,and Efficient (com.anddoes.launcher), v4.9.11 (6093)	Android Does Team	10,000,000	8
Electric Screen for Prank Live Wallpaper &Launcher (mobi.infolife.ezweather.livewallpaper.g2n19), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	10,000,000	7
iLauncher OS13-Phone X style (com.amber.launcher.ios.iphonex.apple.os11), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	1,000,000	7
Galaxy S10 Launcher for Samsung (com.amber.launcher.samsung.s10.galaxy.s9.s8.s10lite), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	1,000,000	7
Super 3D Wallpapers - Super realistic 3D effects (com.super.wallpapers.seat), v1.5.6 (156)	Seat Wallpapers Labs	100,000	4

Table 151: The top 5 Personalization apps that transmitted the most data types during testing.

Top 5 Apps	Developer	# of Installs	Data Types
Nova Launcher (com.feslacoilsw.launcher), v6.2.12 (62012)	TeslaCoil Software	50,000,000	0
Theme Store (com.nearme.themestore), v7.0.0 (7005)	OPPO ColorOS	50,000,000	0
POCO Launcher 2.0 - Customize, Fresh & Clean (com.mi.android.globallauncher), v2.7.4.4 (2070404)	Xiaomi Inc.	10,000,000	0
LED Keyboard Lighting - Mechanical Keyboard RGB (com.flashkeyboard.leds), v5.8.37 (101)	Zayzik Studio	10,000,000	0
Square Home 3 - Launcher : Windows style (com.ss.squarehome2), v2.0.5 (20005)	ChYK the dev.	5,000,000	0

Table 152: The top 5 Personalization apps that transmitted the fewest data types during testing.

D.7.2 App Permissions

Apps in the Personalization category requested the dangerous permissions listed in Table 153.¹⁴⁴

Data Type	# of Apps	(% of Apps)
READ_EXTERNAL_STORAGE	33	(80.5%)
WRITE_EXTERNAL_STORAGE	30	(73.2%)
READ_PHONE_STATE	23	(56.1%)
CAMERA	19	(46.3%)
CALL_PHONE	18	(43.9%)
READ_CONTACTS	18	(43.9%)
ACCESS_COARSE_LOCATION	17	(41.5%)
ACCESS_FINE_LOCATION	17	(41.5%)
READ_CALENDAR	12	(29.3%)
GET_ACCOUNTS	12	(29.3%)
RECORD_AUDIO	10	(24.4%)
WRITE_CONTACTS	6	(14.6%)
ANSWER_PHONE_CALLS	4	(9.8%)
WRITE_CALENDAR	3	(7.3%)
USE_SIP	1	(2.4%)
READ_PHONE_NUMBERS	1	(2.4%)
BODY_SENSORS	1	(2.4%)
ACTIVITY_RECOGNITION	1	(2.4%)
ACCESS_MEDIA_LOCATION	1	(2.4%)
ACCESS_BACKGROUND_LOCATION	1	(2.4%)
ACCEPT_HANDOVER	1	(2.4%)
SEND_SMS	1	(2.4%)
RECEIVE_SMS	1	(2.4%)
RECEIVE_MMS	1	(2.4%)
READ_SMS	1	(2.4%)
READ_CALL_LOG	1	(2.4%)

Table 153: Dangerous permissions requested by apps in the Personalization category.

¹⁴⁴For an explanation of dangerous permissions, see Section 4.3.

D.7.2.1 Popular Apps Requesting Dangerous Permissions For each of these permissions, Table 154 lists the top 5 most popular apps that we observed requesting dangerous permissions during testing.¹⁴⁵

Table 154: The 5 most popular Personalization apps that requested each dangerous permission.

Permission	Top 5 Apps	Developer	# of Installs
READ_EXTERNAL_STORAGE	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
	GO Launcher - 3D parallax Themes & HD Wallpapers (com.gau.go.launcherex), v3.24 (739)	GOMO Live	100,000,000
	Nova Launcher (com.teslacoilsw.launcher), v6.2.12 (62012)	TeslaCoil Software	50,000,000
	Theme Store (com.nearme.themestore), v7.0.0 (7005)	OPPO ColorOS	50,000,000
	Smart Launcher 5 (ginlemon.flowerfree), v5.4 build 034 (1646)	Smart Launcher Team	10,000,000
WRITE_EXTERNAL_STORAGE	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
	GO Launcher - 3D parallax Themes & HD Wallpapers (com.gau.go.launcherex), v3.24 (739)	GOMO Live	100,000,000
	Nova Launcher (com.teslacoilsw.launcher), v6.2.12 (62012)	TeslaCoil Software	50,000,000
	Theme Store (com.nearme.themestore), v7.0.0 (7005)	OPPO ColorOS	50,000,000
	Smart Launcher 5 (ginlemon.flowerfree), v5.4 build 034 (1646)	Smart Launcher Team	10,000,000
READ_PHONE_STATE	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
	GO Launcher - 3D parallax Themes & HD Wallpapers (com.gau.go.launcherex), v3.24 (739)	GOMO Live	100,000,000
	Theme Store (com.nearme.themestore), v7.0.0 (7005)	OPPO ColorOS	50,000,000
	Smart Launcher 5 (ginlemon.flowerfree), v5.4 build 034 (1646)	Smart Launcher Team	10,000,000
	Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000

(Table Continues)

¹⁴⁵Popularity is determined by the number of reported installs in the Google Play Store.

Table 154 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
CAMERA	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
	GO Launcher - 3D parallax Themes & HD Wallpapers (com.gau.go.launcherex), v3.24 (739)	GOMO Live	100,000,000
	Nova Launcher (com.teslacoilsw.launcher), v6.2.12 (62012)	TeslaCoil Software	50,000,000
	Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000
	Electric Screen for Prank Live Wallpaper & Launcher (mobi.infolife.ezweather.livewallpaper.g2n19), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	10,000,000
CALL_PHONE	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
	GO Launcher - 3D parallax Themes & HD Wallpapers (com.gau.go.launcherex), v3.24 (739)	GOMO Live	100,000,000
	Nova Launcher (com.teslacoilsw.launcher), v6.2.12 (62012)	TeslaCoil Software	50,000,000
	Smart Launcher 5 (ginlemon.flowerfree), v5.4 build 034 (1646)	Smart Launcher Team	10,000,000
	Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000
	READ_CONTACTS	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech
GO Launcher - 3D parallax Themes & HD Wallpapers (com.gau.go.launcherex), v3.24 (739)		GOMO Live	100,000,000
Smart Launcher 5 (ginlemon.flowerfree), v5.4 build 034 (1646)		Smart Launcher Team	10,000,000
Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)		Microsoft Corporation	10,000,000
POCO Launcher 2.0 - Customize, Fresh & Clean (com.mi.android.globallauncher), v2.7.4.4 (2070404)		Xiaomi Inc.	10,000,000
ACCESS_COARSE_LOCATION		Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech
	GO Launcher - 3D parallax Themes & HD Wallpapers (com.gau.go.launcherex), v3.24 (739)	GOMO Live	100,000,000
	Microsoft Launcher	Microsoft Corporation	10,000,000

(Table Continues)

Table 154 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(com.microsoft.launcher), v5.11.5.56362 (56362) POCO Launcher 2.0 - Customize, Fresh & Clean (com.mi.android.globallauncher), v2.7.4.4 (2070404)	Xiaomi Inc.	10,000,000
	Apex Launcher - Customize, Secure, and Efficient (com.anddoes.launcher), v4.9.11 (6093)	Android Does Team	10,000,000
ACCESS_FINE_LOCATION			
	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
	GO Launcher - 3D parallax Themes & HD Wallpapers (com.gau.go.launcherex), v3.24 (739)	GOMO Live	100,000,000
	Smart Launcher 5 (ginlemon.flowerfree), v5.4 build 034 (1646)	Smart Launcher Team	10,000,000
	Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000
	POCO Launcher 2.0 - Customize, Fresh & Clean (com.mi.android.globallauncher), v2.7.4.4 (2070404)	Xiaomi Inc.	10,000,000
READ_CALENDAR			
	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
	Smart Launcher 5 (ginlemon.flowerfree), v5.4 build 034 (1646)	Smart Launcher Team	10,000,000
	Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000
	POCO Launcher 2.0 - Customize, Fresh & Clean (com.mi.android.globallauncher), v2.7.4.4 (2070404)	Xiaomi Inc.	10,000,000
	Electric Screen for Prank Live Wallpaper & Launcher (mobi.infolife.ezweather.livewallpaper.g2n19), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	10,000,000
GET_ACCOUNTS			
	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
	GO Launcher - 3D parallax Themes & HD Wallpapers (com.gau.go.launcherex), v3.24 (739)	GOMO Live	100,000,000
	Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000
	Fast Typing Keyboard (com.jb.gokeyboard.theme.timssfasttypingkeyboard), v1.275.18.131 (131)	Launcher 2020 - Themes & Keyboard Apps	10,000,000
	Square Home 3 - Launcher : Windows style (com.ss.squarehome2), v2.0.5 (20005)	ChYK the dev.	5,000,000

(Table Continues)

Table 154 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
RECORD_AUDIO			
	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
	GO Launcher - 3D parallax Themes & HD Wallpapers (com.gau.go.launcherex), v3.24 (739)	GOMO Live	100,000,000
	Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000
	Evie Launcher (is.shortcut), v2.14.8-9 (21408009)	Evie Labs Inc.	5,000,000
	Control Center IOS 13 - Screen Recorder (com.tuanfadbg.controlcenterios), v2.6.9.13.11 (119)	FA developer	1,000,000
WRITE_CONTACTS			
	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
	GO Launcher - 3D parallax Themes & HD Wallpapers (com.gau.go.launcherex), v3.24 (739)	GOMO Live	100,000,000
	Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000
	Electric Screen for Prank Live Wallpaper & Launcher (mobi.infolife.ezweather.livewallpaper.g2n19), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	10,000,000
	iLauncher OS13-Phone X style (com.amber.launcher.ios.iphonex.apple.os11), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	1,000,000
ANSWER_PHONE_CALLS			
	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
	Electric Screen for Prank Live Wallpaper & Launcher (mobi.infolife.ezweather.livewallpaper.g2n19), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	10,000,000
	iLauncher OS13-Phone X style (com.amber.launcher.ios.iphonex.apple.os11), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	1,000,000
	Galaxy S10 Launcher for Samsung (com.amber.launcher.samsung.s10.galaxy.s9.s8.s10lite), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	1,000,000
WRITE_CALENDAR			
	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
	Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000
	Edge Screen - Edge Gesture, Edge Action (Table Continues)	Edge Action Studio	500,000

Table 154 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(com.edgescreeen.edgeaction), v2.3.0 (147)		
USE_SIP	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
READ_PHONE_NUMBERS	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
BODY_SENSORS	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
ACTIVITY_RECOGNITION	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
ACCESS_MEDIA_LOCATION	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
ACCESS_BACKGROUND_LOCATION	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
ACCEPT_HANDOVER	Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000
SEND_SMS	Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000
RECEIVE_SMS	Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000
RECEIVE_MMS	Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000
READ_SMS	Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000
READ_CALL_LOG	Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000

(Table Continues)

Table 154 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(com.microsoft.launcher), v5.11.5.56362 (56362)		

Table 155 lists the 5 most popular Personalization apps that requested the most permissions, whereas Table 156 lists the 5 most popular Personalization apps that requested the fewest permissions.

Top 5 Apps	Developer	# of Installs	Permissions
Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	100,000,000	102
POCO Launcher 2.0 - Customize, Fresh & Clean (com.mi.android.globallauncher), v2.7.4.4 (2070404)	Xiaomi Inc.	10,000,000	57
GO Launcher - 3D parallax Themes & HD Wallpapers (com.gau.go.launcherex), v3.24 (739)	GOMO Live	100,000,000	56
Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	10,000,000	51
DIY color keyboard (com.diy.keyboard), v1.4.5 (2981)	Paredes BLACKGOAT	1,000,000	47

Table 155: The 5 most popular Personalization apps that requested the most permissions.

Top 5 Apps	Developer	# of Installs	Permissions
Battery Screen Saver - Customizable Daydream (com.zas.batteryscreensaver), v1.4.3.4 (16)	Zas	100,000	3
Energy Ring - Galaxy S10/e/5G/+ battery indicator! (you.in.spark.energy.ring), vER_BETA_7.12 (32)	IJP	500,000	4
Energy Ring - Note 10/5G/Lite/+ battery indicator! (you.in.spark.energy.ring.note), vER_NOTE10_1.3 (4)	IJP	100,000	4
Custom AOD (Add images on Always On Display) (com.somen.customaod), v3.0.7 Beta (29)	Dhwani developer	100,000	5
NavBar Animations (No Root) (com.axndx.navbaranimations), v3.0.4 (17)	axndx	500,000	6

Table 156: The 5 most popular Personalization apps that requested the least number of permissions.

D.7.2.2 Permission Usage While the previous subsection depicted the dangerous permissions *requested* by the apps that were tested, Table 157 lists the Personalization apps based on the dangerous permissions that were observed being *used* during the testing period.

Table 157: Personalization apps based on total number of permissions requested, the number of those that are considered “dangerous,” and the percentage of those dangerous permissions that were used during testing.

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
Parallel Space - Multiple accounts & Two face (com.lbe.parallel.intl), v4.0.8934 (10820)	LBE Tech	102	21	4.8
POCO Launcher 2.0 - Customize, Fresh & Clean (com.mi.android.globallauncher), v2.7.4.4 (2070404)	Xiaomi Inc.	57	8	12.5
GO Launcher - 3D parallax Themes & HD Wallpapers (com.gau.go.launcherex), v3.24 (739)	GOMO Live	56	11	9.1
Microsoft Launcher (com.microsoft.launcher), v5.11.5.56362 (56362)	Microsoft Corporation	51	18	16.7
DIY color keyboard (com.diy.keyboard), v1.4.5 (2981)	Paredes BLACKGOAT	47	8	0.0
Galaxy S10 Launcher for Samsung (com.amber.launcher.samsung.s10.galaxy.s9.s8.s10lite), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	41	11	0.0
Electric Screen for Prank Live Wallpaper & Launcher (mobi.infolife.ezweather.livewallpaper.g2n19), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	41	11	9.1
iLauncher OS13-Phone X style (com.amber.launcher.ios.iphonex.apple.os11), v4.7.0.687_50122 (50122)	Weather Widget Theme Dev Team	41	11	9.1
Lawnchair 2 (ch.deletescape.lawnchair.plah), v2.0-2589 (2589)	deletescape	35	5	0.0
Theme Store (com.nearme.themestore), v7.0.0 (7005)	OPPO ColorOS	30	3	0.0
News Home - Full Screen News Widget and Launcher (com.myhomescreen.news), v2.6.21 (3340)	Yobi Mobi	28	9	0.0
hyperion launcher (projekt.launcher), vffity two (52)	prjkt.io	28	4	0.0
Function - Easy Email Inbox & Productivity Tools (com.myhomescreen.email), v2.7.34 (1575)	Yobi Mobi	28	9	11.1
Power Shade: Notification Panel & Quick Settings (com.treydev.pns), v15.71 (1571000)	Treydev Inc	27	5	0.0
Bottom Quick Settings - Notification Customization	Tom Bayley	26	6	0.0

(Table Continues)

Table 157 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(com.tombayley.bottomquicksettings), v6.1.4 (248)				
Evie Launcher (is.shortcut), v2.14.8-9 (21408009)	Evie Labs Inc.	26	9	33.3
Edge Screen - Edge Gesture, Edge Action (com.edgescreen.edgeaction), v2.3.0 (147)	Edge Action Studio	25	11	0.0
Apex Launcher - Customize, Secure, and Efficient (com.anddoes.launcher), v4.9.11 (6093)	Android Does Team	24	7	0.0
Fast Typing Keyboard (com.jb.gokeyboard.theme.timssfasttypingkeyboard), v1.275.18.131 (131)	Launcher 2020 - Themes & Keyboard Apps	23	4	0.0
Smart Launcher 5 (ginlemon.flowerfree), v5.4 build 034 (1646)	Smart Launcher Team	23	7	42.9
Control Center IOS 13 - Screen Recorder (com.tuanfadbg.controlcenterios), v2.6.9.13.11 (119)	FA developer	22	6	0.0
Nova Launcher (com.teslacoilsw.launcher), v6.2.12 (62012)	TeslaCoil Software	19	4	25.0
Magic cleaner PRO (pro.magic.cleaner.boost), v1.45 (45)	Utility App Studio	18	6	0.0
Action Launcher: Pixel Edition (com.actionlauncher.playstore), v45.0 (45000500)	Action Launcher	17	6	16.7
Black Hole - Lock screen (ginlemon.locker.blackHole), v5.4.24 (89)	Smart Launcher Team	17	5	40.0
Square Home 3 - Launcher : Windows style (com.ss.squarehome2), v2.0.5 (20005)	ChYK the dev.	16	7	0.0
Always On Edge - Edge Lighting (com.used.aoe), v5.8.1 (2358101)	Airbea Ent.	14	3	0.0
Pear Launcher (com.pearlauncher.pearlauncher), v2.0.9 (92)	Yajat Kumar	14	3	0.0
Super 3D Wallpapers - Super realistic 3D effects (com.super.wallpapers.seat), v1.5.6 (156)	Seat Wallpapers Labs	12	5	0.0
Muviz -Navbar Music Visualizer (com.perfectapps.muviz), v5.0.5.0 (119)	Sparkine Labs	11	2	0.0
Muviz Edge - Music Visualizer, Edge Music Lighting (com.sparkine.muvizedge), v1.1.3.0 (26)	Sparkine Labs	11	2	0.0
Minimalist launcher for focus Before Launcher (com.beforesoff.launcher), v3.0.1 (255)	Before Labs	11	2	50.0
NotifyBuddy - AMOLED Notification Light (com.xander.android.notifybuddy), v1.81 (89)	XanderApps	8	0	0.0
Stylish -Customize Your Navbar & Weather Widget (com.stylishforandroid.stylishforandroid), v1.1.1 (11)	Stylish for Android	8	1	0.0

(Table Continues)

Table 157 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
(com.stylish.stylebar), v1.0.485 (10485)				
Galaxy Wild Wolf Keyboard Theme (com.ikeyboard.theme.galaxy.wild.wolf), v1.0 (30)	Free keyboard for Android-2020 theme apps	8	2	0.0
LED Keyboard Lighting - Mechanical Keyboard RGB (com.flashkeyboard.leds), v5.8.37 (101)	Zayzik Studio	7	1	0.0
NavBar Animations (No Root) (com.axndx.navbaranimations), v3.0.4 (17)	axndx	6	0	0.0
Custom AOD (Add images on Always On Display) (com.somen.customaod), v3.0.7 Beta (29)	Dhwani developer	5	1	0.0
Energy Ring - Galaxy S10/e/5G/+ battery indicator! (you.in.spark.energy.ring), vER_BETA_7.12 (32)	IJP	4	0	0.0
Energy Ring - Note 10/5G/Lite/+ battery indicator! (you.in.spark.energy.ring.note), vER_NOTE10_1.3 (4)	IJP	4	0	0.0
Battery Screen Saver - Customizable Daydream (com.zas.batteryscreensaver), v1.4.3.4 (16)	Zas	3	0	0.0

D.7.3 Third-Party SDKs

We were able to identify 97 SDKs embedded within the 41 Personalization apps. We list the 40 most common SDKs in Table 158,¹⁴⁶ along with the number of Personalization apps in which they were detected.

Table 158: The 40 most common SDKs identified within apps in the Personalization category.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	37	(90.2%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	35	(85.4%)
Google Ads	Google	Advertisement	31	(75.6%)
Google DoubleClick	Google	Advertisement	24	(58.5%)
Google Gson	Google	Development Aid	22	(53.7%)
Google Play	Google Play	App Market	21	(51.2%)
Glide	Bump Technologies	Development Aid	20	(48.8%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	19	(46.3%)
Github	Github	Development Aid	17	(41.5%)
Crashlytics	Google	Mobile Analytics	16	(39.0%)
Facebook Ads	Facebook	Advertisement	14	(34.1%)
Apache Common	The Apache Software Founda- tion	Development Aid	14	(34.1%)
picasso	Square Inc.	Development Aid	12	(29.3%)
Facebook Analytics	Facebook	Mobile Analytics	12	(29.3%)
Facebook Login	Facebook	Digital Identity Advertisement	12	(29.3%)

(Table Continues)

¹⁴⁶For an explanation of SDKs, see Section 4.1.2.

Table 158 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
		Mobile Analytics		
Facebook Share	Facebook	Social Network Advertisement Mobile Analytics	12	(29.3%)
ZXing ('Zebra Crossing')	ZXing Project	Development Aid	12	(29.3%)
Facebook Places	Facebook	Map/LBS Advertisement	10	(24.4%)
Google Protocol Buffers	Google	Development Aid	10	(24.4%)
MoPub	Twitter	Advertisement	9	(22.0%)
Moat	Oracle	Mobile Analytics	8	(19.5%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	7	(17.1%)
Apache Http	The Apache Software Founda- tion	Development Aid	7	(17.1%)
Google Analytics	Google	Mobile Analytics	7	(17.1%)
Android Support v4	Google	Development Aid	7	(17.1%)
Integral Ad Science	Integral Ad Science Inc.	Mobile Analytics Advertisement AdFraud	7	(17.1%)
getui	getui	Advertisement Mobile Analytics Push Notifications	6	(14.6%)
Google Core Libraries for Java 6+	Google	Development Aid	6	(14.6%)
Nine Old Androids	Nine Old Androids	Development Aid	6	(14.6%)
MaterialProgressBar	MaterialProgressBar	Development Aid	5	(12.2%)
Volley HTTP library	Google	Development Aid Networking	5	(12.2%)
Fasterxml	FasterXML	Utility	5	(12.2%)
OkHttp	OkHttp	Development Aid	5	(12.2%)
AppMonet	Monet Engine Inc.	Advertisement	5	(12.2%)
Smaato	Smaato	Advertisement	5	(12.2%)

(Table Continues)

Table 158 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
		LBS		
Bugly	Tencent	Mobile Analytics	5	(12.2%)
Roboguice	Square	Development Aid	4	(9.8%)
Branch	Branch Metrics	Mobile Analytics Advertisement	4	(9.8%)
Nostra13 Image Loading	Nostra13 Image Loading	Development Aid	4	(9.8%)
Google API Client Libraries	Google	Development Framework	4	(9.8%)

Several of these SDKs included developer tools, which we characterize as SDKs that provide tools and functionality to app developers which are unlikely to be used for the transmission of user information. As a result, we separately present Table 159, which depicts the 40 most common SDKs with developer tools removed, along with the number of Personalization apps in which they were detected.

Table 159: The 40 most common SDKs identified within apps in the Personalization category, with developer tools removed.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	37	(90.2%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	35	(85.4%)
Google Ads	Google	Advertisement	31	(75.6%)
Google DoubleClick	Google	Advertisement	24	(58.5%)
Google Play	Google Play	App Market	21	(51.2%)
Facebook	Facebook	Social Network	19	(46.3%)

(Table Continues)

Table 159 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
		Advertisement Mobile Analytics		
Crashlytics	Google	Mobile Analytics	16	(39.0%)
Facebook Ads	Facebook	Advertisement	14	(34.1%)
Facebook Analytics	Facebook	Mobile Analytics	12	(29.3%)
Facebook Login	Facebook	Digital Identity Advertisement Mobile Analytics	12	(29.3%)
Facebook Share	Facebook	Social Network Advertisement Mobile Analytics	12	(29.3%)
Facebook Places	Facebook	Map/LBS Advertisement	10	(24.4%)
MoPub	Twitter	Advertisement	9	(22.0%)
Moat	Oracle	Mobile Analytics	8	(19.5%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	7	(17.1%)
Google Analytics	Google	Mobile Analytics	7	(17.1%)
Integral Ad Science	Integral Ad Science Inc.	Mobile Analytics Advertisement AdFraud	7	(17.1%)
getui	getui	Advertisement Mobile Analytics Push Notifications	6	(14.6%)
Volley HTTP library	Google	Development Aid Networking	5	(12.2%)
AppMonet	Monet Engine Inc.	Advertisement	5	(12.2%)
Smaato	Smaato	Advertisement LBS	5	(12.2%)
Bugly	Tencent	Mobile Analytics	5	(12.2%)
Branch	Branch Metrics	Mobile Analytics	4	(9.8%)

(Table Continues)

Table 159 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
		Advertisement		
Flurry	Verizon	Mobile Analytics	4	(9.8%)
PubNative	PubNative	Advertisement	4	(9.8%)
Google Tag Manager	Google	Mobile Analytics	3	(7.3%)
Applovin	AppLovin	Advertisement	3	(7.3%)
Google Admob	Google	Advertisement	3	(7.3%)
Taboola	Taboola	Advertisement	2	(4.9%)
Inmobi	InMobi	Advertisement	2	(4.9%)
Umeng Analytics	Alibaba	Mobile Analytics	2	(4.9%)
Bugsnag	Bugsnag	Mobile Analytics	1	(2.4%)
Amplitude	Amplitude	Mobile Analytics	1	(2.4%)
adjust	Adjust	Mobile Analytics Advertisement	1	(2.4%)
Microsoft Appcenter Analytics	Microsoft	Mobile Analytics	1	(2.4%)
Bugfender	Mobile Jazz	Mobile Analytics	1	(2.4%)
Sensors Analytics	"Shence Network Technology (Beijing) Co.	https://www.sensorsdata.cn	1	(2.4%)
Vungle	Vungle	Advertisement	1	(2.4%)
AdColony	AdColony	Advertisement	1	(2.4%)
AerServ	InMobi	Mobile Analytics	1	(2.4%)

D.8 Finance Apps

D.8.1 Data Types Transmitted

Apps in the Finance category were observed transmitting the data types listed in Table 160 during the testing period.¹⁴⁷

Data Type	# of Apps	(% of Apps)
AAID	14	(41.2%)
Android ID	12	(35.3%)
GPS Location	3	(8.8%)
Coarse Location	3	(8.8%)
WiFi BSSID	2	(5.9%)
WiFi SSID	2	(5.9%)
GSF ID	1	(2.9%)
Serial #	1	(2.9%)
IMSI	1	(2.9%)
SIM ID	1	(2.9%)
IMEI	1	(2.9%)

Table 160: Data types transmitted by apps in the Finance category during the testing period.

¹⁴⁷For an explanation of these data types, see Section 3.

D.8.1.1 Most Common Hostnames Contacted

Table 161 depicts the top 10 hostnames observed being contacted by Finance apps during the testing period, whereas Table 162 depicts the top 10 parent companies corresponding to these hostnames. This data reflects Internet servers that were *contacted* by apps, but does not necessarily mean that they received sensitive user information—we specifically discuss that subset of recipients in Section D.8.1.2.¹⁴⁸ The discrepancy between the two sections is due to the fact that some app transmissions may simply not contain sensitive user information or that its transmission was obfuscated using a method that we did not immediately recognize.

Hostname	Parent Company	# of Apps	(% of Apps)
settings.crashlytics.com	Google	12	(35.3%)
assets.adobedtm.com	Adobe	9	(26.5%)
dpm.demdex.net	Adobe	7	(20.6%)
googleads.g.doubleclick.net	Google	6	(17.6%)
firebaseconfig.firebaseio.com	Google	3	(8.8%)
mobile-collector.newrelic.com	New Relic	3	(8.8%)
parse.fusion.com.au	Fusion	3	(8.8%)
api2.branch.io	Branch Metrics	3	(8.8%)
cdn.branch.io	Branch Metrics	3	(8.8%)
in.appcenter.ms	Microsoft	3	(8.8%)

Table 161: The top 10 most common hostnames contacted by Finance apps during testing.

Company	# of Apps	(% of Apps)
Google	17	(50.0%)
Adobe	10	(29.4%)
Microsoft	4	(11.8%)
Facebook	3	(8.8%)
Appdynamics	3	(8.8%)
LaunchDarkly	3	(8.8%)
New Relic	3	(8.8%)
Fusion	3	(8.8%)
Verizon	3	(8.8%)
Branch Metrics	3	(8.8%)

Table 162: The top 10 most common companies contacted by Finance apps during testing.

¹⁴⁸We define “user information” in Section 3.

D.8.1.2 Most Common Data Recipients

Table 163 depicts the top 10 data recipients among the Finance apps during the testing period. Table 164 lists additional information about the most common data recipients, such as the approximate locations of their servers, IP addresses contacted during testing, and the types of sensitive user information that we observed them receive during the testing period.

Hostname	Parent Company	# of Apps	(% of Apps)
settings.crashlytics.com	Google	3	(8.8%)
api2.branch.io	Branch Metrics	3	(8.8%)
graph.facebook.com	Facebook	2	(5.9%)
api.amplitude.com	Amplitude	2	(5.9%)
aappapi.investing.com	Investing.com	1	(2.9%)
firebaseremoteconfig.googleapis.com	Google	1	(2.9%)
register.appsflyer.com	AppsFlyer	1	(2.9%)
clientstream.launchdarkly.com	LaunchDarkly	1	(2.9%)
syd-col.eum-appdynamics.com	Appdynamics	1	(2.9%)
api.nab.com.au	National Australia Bank	1	(2.9%)

Table 163: The top 10 most common data recipients from Finance apps during testing.

Table 164: The 10 most common recipient hostnames of user information from Finance apps during the testing period, along with their IP addresses, company information, and the data types that were observed being transmitted.

Parent Company	Country	IPs	Received Data
settings.crashlytics.com			
Google	United States	172.217.167.99 (US) 142.250.66.163 (US) 142.250.66.195 (US)	Android ID AAID
api2.branch.io			
Branch Metrics	United States	99.86.212.51 (US) 13.226.111.122 (US) 99.86.212.76 (US)	Android ID AAID
api.amplitude.com			
Amplitude	United States	34.210.13.12 (US) 52.26.27.141 (US)	GPS Location Coarse Location AAID
graph.facebook.com			
Facebook	United States	157.240.8.18 (US)	AAID
api-m.paypal.com			
eBay	United States	151.101.30.133 (AU)	Android ID IMSI GSF ID AAID GPS Location WIFI BSSID WIFI SSID Serial # Coarse Location IMEI SIM ID
c.paypal.com			
eBay	United States	104.74.32.34 (US)	Android ID IMSI GSF ID GPS Location WIFI BSSID WIFI SSID Serial # Coarse Location IMEI SIM ID
control.kochava.com			

(Table Continues)

Table 164 (Continued)

Parent Company	Country	IPs	Received Data
Kochava	United States	107.178.254.148 (US)	WiFi SSID WiFi BSSID Android ID AAID
firebaseremoteconfig.googleapis.com			
Google	United States	142.250.66.170 (US) 142.250.66.202 (US) 216.58.200.106 (US)	Android ID AAID
api.nab.com.au			
National Australia Bank	Australia	104.68.25.48 (US)	Android ID AAID
mobileapi.heritage.com.au			
		103.243.148.116 (AU)	GPS Location Coarse Location

D.8.1.3 Apps Ranked by Number of Recipients

Table 165 ranks the Finance apps based on the number of recipients to which we detected each transmit sensitive user information during testing.

Table 165: Finance apps ordered by the number of recipients (by unique hostnames and their parent companies) during the testing period.

App	Developer	Installs	Recipients	
			Hostnames	Companies
Investing.com: Stocks, Finance, Markets & News Package Name: com.fusionmedia.investing Version: 5.9 (1241)	INVESTING.com	10,000,000	4	4
CNBC: Breaking Business News & Live Market Data Package Name: com.cnbc.client Version: 3.8.1 (4621)	NBCUniversal Media, LLC	1,000,000	4	4
NAB Mobile Banking Package Name: au.com.nab.mobile Version: 9.46.1 (1278)	NAB	1,000,000	4	3
Bendigo Bank Package Name: com.bendigobank.mobile Version: 4.8.5 (1441)	Bendigo and Adelaide Bank Ltd	500,000	3	3
Zip - Shop Now, Pay Later Package Name: co.zip Version: 1.2.5 b0e3b886 (1002050)	zip.co	500,000	3	3
Wealthsimple Trade Package Name: com.wealthsimple.trade Version: 1.25.2 (309)	Wealthsimple	100,000	3	3
IG Trading: Spread Betting, CFDs, Forex & Stocks Package Name: com.iggroup.android.cfd Version: 3.30.3 (420303)	IG Group	500,000	2	2
Up - Super Powered Banking Package Name: au.com.up.money Version: 1.13.5 (1508)	Up Money	100,000	2	2
PayPal Mobile Cash: Send and Request Money Fast Package Name: com.paypal.android.p2pmobile Version: 7.26.1 (1150073604)	PayPal Mobile	100,000,000	2	1
Yahoo Finance Package Name: com.yahoo.mobile.client.android.finance Version: 9.3.2 (1330761596)	Yahoo	10,000,000	7	1
People's Choice Credit Union Package Name: com.fusion.ATMLocator Version: 3.6b4 (109)	People's Choice Credit Union	100,000	1	1

(Table Continues)

Table 165 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Heritage Mobile Banking Package Name: au.com.heritage.app Version: 5.8.4 (39)	Heritage Bank AU	100,000	1	1
Beyond Bank Australia Package Name: com.fusion.beyondbank Version: 2.10b9 (123)	Beyond Bank Australia	50,000	1	1
UBank Mobile Banking Package Name: au.com.ubank.internetbanking Version: 5.7.0 (183)	NAB	50,000	2	1
Bank Australia app Package Name: com.fusion.banking Version: 3.12b5 (155)	Bank Australia Limited	10,000	2	1
US Stock Market Package Name: com.usstocks.markets Version: 4.3 (34)	StocksAndro	10,000	2	1
Google Pay: Pay with your phone and send cash Package Name: com.google.android.apps.walletnfcvel Version: 2.111.306893647 (930206576)	Google LLC	100,000,000	0	0
CommBank Package Name: com.commbank.netbank Version: 4.8.1.1760 (1760)	Commonwealth Bank of Australia	5,000,000	0	0
ANZ Australia Package Name: com.anz.android.gomoney Version: 4.23.1.0062 (423010062)	Australia and New Zealand Banking Group Limited	1,000,000	0	0
Westpac Mobile Banking Package Name: org.westpac.bank Version: 8.9 (60890)	Westpac Banking Corporation	1,000,000	0	0
증권통 Package Name: semaphore.stockclient Version: 6.2.723.723 (723)	Tomato Group	1,000,000	0	0
Market+ Mobile Package Name: com.aastocks.dzh Version: 6.39.1 (639011)	AASTOCKS	1,000,000	0	0
ING Australia Banking Package Name: au.com.ingdirect.android Version: 8.3.9 (80)	ING Australia	500,000	0	0
St.George Mobile Banking Package Name: org.stgeorge.bank Version: 8.24 (8204)	St.George Bank	500,000	0	0
Bankwest Package Name: au.com.bankwest.mobile	Bankwest	500,000	0	0

(Table Continues)

Table 165 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Version: 3.27.0 (24114) CUA Mobile Banking Package Name: au.com.cua.mb Version: 4.9.6 (4090664)	Credit Union Australia	100,000	0	0
BOQ Mobile Package Name: com.bankofqueensland.boq Version: 1.4.1 (10402)	BOQ	100,000	0	0
CommSec Package Name: au.com.commsec.android.CommSec Version: 4.22.0 (6102)	CommSec	100,000	0	0
Bank of Melbourne Mobile Banking Package Name: org.bom.bank Version: 8.3 (8300)	St.George Bank	100,000	0	0
BankSA Mobile Banking Package Name: org.banksa.bank Version: 8.3 (8300)	St.George Bank	100,000	0	0
Greater Bank Package Name: com.greater.Greater Version: 4.7.0 (22)	Greater Bank Ltd	100,000	0	0
Exchange Rates Package Name: com.despdev.currencyconverter Version: 3.6 (36)	despDev	100,000	0	0
Suncorp Bank Package Name: au.com.suncorp.SuncorpBank Version: 7.1.4 (2003042910)	Suncorp Network	100,000	0	0
SelfWealth Package Name: au.com.selfwealth.mobile Version: 1.0.81 (81)	SelfWealth Limited	10,000	0	0

D.8.1.4 Popular Apps Transmitting Each Data Type

For each of these data types, Table 166 lists the top 5 most popular Finance apps that we observed transmitting them during testing.¹⁴⁹

Table 166: The top 5 Finance apps that we detected transmitting each data type during the testing period.

Data Type	Top 5 Apps	Developer	# of Installs
AAID	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000
	Investing.com: Stocks, Finance, Markets & News (com.fusionmedia.investing), v5.9 (1241)	INVESTING.com	10,000,000
	Yahoo Finance (com.yahoo.mobile.client.android.finance), (1330761596)	Yahoo v9.3.2	10,000,000
	NAB Mobile Banking (au.com.nab.mobile), v9.46.1 (1278)	NAB	1,000,000
	CNBC: Breaking Business News & Live Market Data (com.cnbc.client), v3.8.1 (4621)	NBCUniversal Media, LLC	1,000,000
Android ID	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000
	Investing.com: Stocks, Finance, Markets & News (com.fusionmedia.investing), v5.9 (1241)	INVESTING.com	10,000,000
	NAB Mobile Banking (au.com.nab.mobile), v9.46.1 (1278)	NAB	1,000,000
	CNBC: Breaking Business News & Live Market Data (com.cnbc.client), v3.8.1 (4621)	NBCUniversal Media, LLC	1,000,000
	Bendigo Bank (com.bendigobank.mobile), v4.8.5 (1441)	Bendigo and Adelaide Bank Ltd	500,000
GPS Location	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000
	Zip - Shop Now, Pay Later (co.zip), v1.2.5 b0e3b886 (1002050)	zip.co	500,000
	Heritage Mobile Banking (au.com.heritage.app), v5.8.4 (39)	Heritage Bank AU	100,000
Coarse Location	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000

(Table Continues)

¹⁴⁹Popularity is determined by the number of reported installs in the Google Play Store.

Table 166 (Continued)

Data Type	Top 5 Apps	Developer	# of Installs
	Zip - Shop Now, Pay Later (co.zip), v1.2.5 b0e3b886 (1002050)	zip.co	500,000
	Heritage Mobile Banking (au.com.heritage.app), v5.8.4 (39)	Heritage Bank AU	100,000
WiFi BSSID	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000
	CNBC: Breaking Business News & Live Market Data (com.cnbc.client), v3.8.1 (4621)	NBCUniversal Media, LLC	1,000,000
WiFi SSID	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000
	CNBC: Breaking Business News & Live Market Data (com.cnbc.client), v3.8.1 (4621)	NBCUniversal Media, LLC	1,000,000
GSF ID	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000
Serial #	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000
IMSI	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000
SIM ID	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000
IMEI	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000

Table 167 lists the 5 most popular Finance apps that transmitted the most data types during the testing period, whereas Table 168 lists the 5 most popular Finance apps that transmitted the fewest data types during the testing period.

Top 5 Apps	Developer	# of Installs	Data Types
PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000	11
CNBC: Breaking Business News & Live Market Data (com.cnbc.client), v3.8.1 (4621)	NBCUniversal Media, LLC	1,000,000	4
Zip - Shop Now, Pay Later (co.zip), v1.2.5 b0e3b886 (1002050)	zip.co	500,000	4
Investing.com: Stocks, Finance, Markets & News (com.fusionmedia.investing), v5.9 (1241)	INVESTING.com	10,000,000	2
NAB Mobile Banking (au.com.nab.mobile), v9.46.1 (1278)	NAB	1,000,000	2

Table 167: The top 5 Finance apps that transmitted the most data types during testing.

Top 5 Apps	Developer	# of Installs	Data Types
Google Pay: Pay with your phone and send cash (com.google.android.apps.walletnfcrel), v2.111.306893647 (930206576)	Google LLC	100,000,000	0
CommBank (com.commbank.netbank), v4.8.1.1760 (1760)	Commonwealth Bank of Australia	5,000,000	0
ANZ Australia (com.anz.android.gomoney), v4.23.1.0062 (423010062)	Australia and New Zealand Banking Group Limited	1,000,000	0
Westpac Mobile Banking (org.westpac.bank), v8.9 (60890)	Westpac Banking Corporation	1,000,000	0
증권통 (semaphore.stockclient), v6.2.723.723 (723)	Tomato Group	1,000,000	0

Table 168: The top 5 Finance apps that transmitted the fewest data types during testing.

D.8.2 App Permissions

Apps in the Finance category requested the dangerous permissions listed in Table 169.¹⁵⁰

Data Type	# of Apps	(% of Apps)
WRITE_EXTERNAL_STORAGE	23	(67.6%)
ACCESS_COARSE_LOCATION	21	(61.8%)
ACCESS_FINE_LOCATION	20	(58.8%)
READ_EXTERNAL_STORAGE	19	(55.9%)
READ_PHONE_STATE	16	(47.1%)
READ_CONTACTS	16	(47.1%)
GET_ACCOUNTS	13	(38.2%)
CAMERA	13	(38.2%)
CALL_PHONE	10	(29.4%)
WRITE_CONTACTS	6	(17.6%)
WRITE_CALENDAR	2	(5.9%)
RECORD_AUDIO	2	(5.9%)
READ_CALENDAR	2	(5.9%)
ACCESS_BACKGROUND_LOCATION	2	(5.9%)

Table 169: Dangerous permissions requested by apps in the Finance category.

¹⁵⁰For an explanation of dangerous permissions, see Section 4.3.

D.8.2.1 Popular Apps Requesting Dangerous Permissions For each of these permissions, Table 170 lists the top 5 most popular apps that we observed requesting dangerous permissions during testing.¹⁵¹

Table 170: The 5 most popular Finance apps that requested each dangerous permission.

Permission	Top 5 Apps	Developer	# of Installs
WRITE_EXTERNAL_STORAGE	Google Pay: Pay with your phone and send cash (com.google.android.apps.walletnfcrel), v2.111.306893647 (930206576)	Google LLC	100,000,000
	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000
	Investing.com: Stocks, Finance, Markets & News (com.fusionmedia.investing), v5.9 (1241)	INVESTING.com	10,000,000
	ANZ Australia (com.anz.android.gomoney), v4.23.1.0062 (423010062)	Australia and New Zealand Banking Group Limited	1,000,000
	Westpac Mobile Banking (org.westpac.bank), v8.9 (60890)	Westpac Banking Corporation	1,000,000
	ACCESS_COARSE_LOCATION	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile
	Yahoo Finance (com.yahoo.mobile.client.android.finance), v9.3.2 (1330761596)	Yahoo	10,000,000
	CommBank (com.commbank.netbank), v4.8.1.1760 (1760)	Commonwealth Bank of Australia	5,000,000
	NAB Mobile Banking (au.com.nab.mobile), v9.46.1 (1278)	NAB	1,000,000
	Westpac Mobile Banking (org.westpac.bank), v8.9 (60890)	Westpac Banking Corporation	1,000,000
ACCESS_FINE_LOCATION	Google Pay: Pay with your phone and send cash (com.google.android.apps.walletnfcrel), v2.111.306893647 (930206576)	Google LLC	100,000,000
	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000
	CommBank (com.commbank.netbank), v4.8.1.1760 (1760)	Commonwealth Bank of Australia	5,000,000
	ANZ Australia (com.anz.android.gomoney), v4.23.1.0062 (423010062)	Australia and New Zealand Banking Group Limited	1,000,000
	Westpac Mobile Banking (org.westpac.bank), v8.9 (60890)	Westpac Banking Corporation	1,000,000
		(Table Continues)	

¹⁵¹ Popularity is determined by the number of reported installs in the Google Play Store.

Table 170 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(org.westpac.bank), v8.9 (60890)		
READ_EXTERNAL_STORAGE			
	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000
	Investing.com: Stocks, Finance, Markets & News (com.fusionmedia.investing), v5.9 (1241)	INVESTING.com	10,000,000
	Yahoo Finance (com.yahoo.mobile.client.android.finance), v9.3.2 (1330761596)	Yahoo	10,000,000
	Westpac Mobile Banking (org.westpac.bank), v8.9 (60890)	Westpac Banking Corporation	1,000,000
	CNBC: Breaking Business News & Live Market Data (com.cnbc.client), v3.8.1 (4621)	NBCUniversal Media, LLC	1,000,000
READ_PHONE_STATE			
	Google Pay: Pay with your phone and send cash (com.google.android.apps.walletnfcrel), v2.111.306893647 (930206576)	Google LLC	100,000,000
	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000
	Investing.com: Stocks, Finance, Markets & News (com.fusionmedia.investing), v5.9 (1241)	INVESTING.com	10,000,000
	CommBank (com.commbank.netbank), v4.8.1.1760 (1760)	Commonwealth Bank of Australia	5,000,000
	ANZ Australia (com.anz.android.gomoney), v4.23.1.0062 (423010062)	Australia and New Zealand Banking Group Limited	1,000,000
READ_CONTACTS			
	Google Pay: Pay with your phone and send cash (com.google.android.apps.walletnfcrel), v2.111.306893647 (930206576)	Google LLC	100,000,000
	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000
	CommBank (com.commbank.netbank), v4.8.1.1760 (1760)	Commonwealth Bank of Australia	5,000,000
	ANZ Australia (com.anz.android.gomoney), v4.23.1.0062 (423010062)	Australia and New Zealand Banking Group Limited	1,000,000
	Westpac Mobile Banking (org.westpac.bank), v8.9 (60890)	Westpac Banking Corporation	1,000,000
GET_ACCOUNTS			
	Google Pay: Pay with your phone and send cash (com.google.android.apps.walletnfcrel), v2.111.306893647 (930206576)	Google LLC	100,000,000

(Table Continues)

Table 170 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	Investing.com: Stocks, Finance, Markets & News (com.fusionmedia.investing), v5.9 (1241)	INVESTING.com	10,000,000
	Yahoo Finance (com.yahoo.mobile.client.android.finance), (1330761596)	v9.3.2 Yahoo	10,000,000
	CommBank (com.commbank.netbank), v4.8.1.1760 (1760)	Commonwealth Bank of Australia	5,000,000
	Westpac Mobile Banking (org.westpac.bank), v8.9 (60890)	Westpac Banking Corporation	1,000,000
CAMERA			
	Google Pay: Pay with your phone and send cash (com.google.android.apps.walletnfcrel), v2.111.306893647 (930206576)	Google LLC	100,000,000
	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000
	CommBank (com.commbank.netbank), v4.8.1.1760 (1760)	Commonwealth Bank of Australia	5,000,000
	ANZ Australia (com.anz.android.gomoney), v4.23.1.0062 (423010062)	Australia and New Zealand Banking Group Limited	1,000,000
	Westpac Mobile Banking (org.westpac.bank), v8.9 (60890)	Westpac Banking Corporation	1,000,000
CALL_PHONE			
	CommBank (com.commbank.netbank), v4.8.1.1760 (1760)	Commonwealth Bank of Australia	5,000,000
	ANZ Australia (com.anz.android.gomoney), v4.23.1.0062 (423010062)	Australia and New Zealand Banking Group Limited	1,000,000
	Westpac Mobile Banking (org.westpac.bank), v8.9 (60890)	Westpac Banking Corporation	1,000,000
	St.George Mobile Banking (org.stgeorge.bank), v8.24 (8204)	St.George Bank	500,000
	Bank of Melbourne Mobile Banking (org.bom.bank), v8.3 (8300)	St.George Bank	100,000
WRITE_CONTACTS			
	PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000
	CommBank (com.commbank.netbank), v4.8.1.1760 (1760)	Commonwealth Bank of Australia	5,000,000
	St.George Mobile Banking (org.stgeorge.bank), v8.24 (8204)	St.George Bank	500,000
	BOQ Mobile (com.bankofqueensland.boq), v1.4.1 (10402)	BOQ	100,000

(Table Continues)

Table 170 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	Bank of Melbourne Mobile Banking (org.bom.bank), v8.3 (8300)	St.George Bank	100,000
WRITE_CALENDAR			
	ANZ Australia (com.anz.android.gomoney), v4.23.1.0062 (423010062)	Australia and New Zealand Banking Group Limited	1,000,000
	CommSec (au.com.commsec.android.CommSec), v4.22.0 (6102)	CommSec	100,000
RECORD_AUDIO			
	ANZ Australia (com.anz.android.gomoney), v4.23.1.0062 (423010062)	Australia and New Zealand Banking Group Limited	1,000,000
	IG Trading: Spread Betting, CFDs, Forex & Stocks (com.iggroup.android.cfd), v3.30.3 (420303)	IG Group	500,000
READ_CALENDAR			
	ANZ Australia (com.anz.android.gomoney), v4.23.1.0062 (423010062)	Australia and New Zealand Banking Group Limited	1,000,000
	CommSec (au.com.commsec.android.CommSec), v4.22.0 (6102)	CommSec	100,000
ACCESS_BACKGROUND_LOCATION			
	Bank of Melbourne Mobile Banking (org.bom.bank), v8.3 (8300)	St.George Bank	100,000
	BankSA Mobile Banking (org.banksa.bank), v8.3 (8300)	St.George Bank	100,000

Table 171 lists the 5 most popular Finance apps that requested the most permissions, whereas Table 172 lists the 5 most popular Finance apps that requested the fewest permissions.

Top 5 Apps	Developer	# of Installs	Permissions
Westpac Mobile Banking (org.westpac.bank), v8.9 (60890)	Westpac Banking Corporation	1,000,000	27
PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	100,000,000	23
Bank of Melbourne Mobile Banking (org.bom.bank), v8.3 (8300)	St.George Bank	100,000	23
BankSA Mobile Banking (org.banksa.bank), v8.3 (8300)	St.George Bank	100,000	23
St.George Mobile Banking (org.stgeorge.bank), v8.24 (8204)	St.George Bank	500,000	22

Table 171: The 5 most popular Finance apps that requested the most permissions.

Top 5 Apps	Developer	# of Installs	Permissions
ING Australia Banking (au.com.ingdirect.android), v8.3.9 (80)	ING Australia	500,000	2
UBank Mobile Banking (au.com.ubank.internetbanking), v5.7.0 (183)	NAB	50,000	2
US Stock Market (com.usstocks.markets), v4.3 (34)	StocksAndro	10,000	3
NAB Mobile Banking (au.com.nab.mobile), v9.46.1 (1278)	NAB	1,000,000	4
Exchange Rates (com.despdev.currencyconverter), v3.6 (36)	despdev	100,000	4

Table 172: The 5 most popular Finance apps that requested the least number of permissions.

D.8.2.2 Permission Usage While the previous subsection depicted the dangerous permissions *requested* by the apps that were tested, Table 173 lists the Finance apps based on the dangerous permissions that were observed being *used* during the testing period.

Table 173: Finance apps based on total number of permissions requested, the number of those that are considered “dangerous,” and the percentage of those dangerous permissions that were used during testing.

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
Westpac Mobile Banking (org.westpac.bank), v8.9 (60890)	Westpac Banking Corporation	27	9	0.0
PayPal Mobile Cash: Send and Request Money Fast (com.paypal.android.p2pmobile), v7.26.1 (1150073604)	PayPal Mobile	23	8	0.0
Bank of Melbourne Mobile Banking (org.bom.bank), v8.3 (8300)	St.George Bank	23	11	27.3
BankSA Mobile Banking (org.banksa.bank), v8.3 (8300)	St.George Bank	23	11	27.3
St.George Mobile Banking (org.stgeorge.bank), v8.24 (8204)	St.George Bank	22	10	0.0
CommBank (com.commbank.netbank), v4.8.1.1760 (1760)	Commonwealth Bank of Australia	18	8	0.0
Google Pay: Pay with your phone and send cash (com.google.android.apps.walletnfcrel), v2.111.306893647 (930206576)	Google LLC	17	6	0.0
ANZ Australia (com.anz.android.gomoney), v4.23.1.0062 (423010062)	Australia and New Zealand Banking Group Limited	16	9	0.0
Bank Australia app (com.fusion.banking), v3.12b5 (155)	Bank Australia Limited	16	7	0.0
Beyond Bank Australia (com.fusion.beyondbank), v2.10b9 (123)	Beyond Bank Australia	16	8	0.0
People’s Choice Credit Union (com.fusion.ATMLocator), v3.6b4 (109)	People’s Choice Credit Union	15	7	0.0
CNBC: Breaking Business News & Live Market Data (com.cnbc.client), v3.8.1 (4621)	NBCUniversal Media, LLC	15	5	0.0
Bankwest (au.com.bankwest.mobile), v3.27.0 (24114)	Bankwest	13	6	0.0
Yahoo Finance (com.yahoo.mobile.client.android.finance), v9.3.2 (1330761596)	Yahoo	13	3	0.0
Up - Super Powered Banking (au.com.up.money), v1.13.5 (1508)	Up Money	13	4	0.0

(Table Continues)

Table 173 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
IG Trading: Spread Betting, CFDs, Forex & Stocks (com.iggroup.android.cfd), v3.30.3 (420303)	IG Group	13	4	0.0
Wealthsimple Trade (com.wealthsimple.trade), v1.25.2 (309)	Wealthsimple	13	3	0.0
Zip - Shop Now, Pay Later (co.zip), v1.2.5 b0e3b886 (1002050)	zip.co	13	6	0.0
Bendigo Bank (com.bendigobank.mobile), v4.8.5 (1441)	Bendigo and Adelaide Bank Ltd	12	4	0.0
Heritage Mobile Banking (au.com.heritage.app), v5.8.4 (39)	Heritage Bank AU	12	5	20.0
CUA Mobile Banking (au.com.cua.mb), v4.9.6 (4090664)	Credit Union Australia	11	3	0.0
Market+ Mobile (com.aastocks.dzh), v6.39.1 (639011)	AASTOCKS	10	4	0.0
Greater Bank (com.greater.Greater), v4.7.0 (22)	Greater Bank Ltd	10	4	25.0
증권통 (semaphore.stockclient), v6.2.723.723 (723)	Tomato Group	10	3	33.3
Investing.com: Stocks, Finance, Markets & News (com.fusionmedia.investing), v5.9 (1241)	INVESTING.com	9	4	0.0
CommSec (au.com.commsec.android.CommSec), v4.22.0 (6102)	CommSec	9	2	0.0
Suncorp Bank (au.com.suncorp.SuncorpBank), v7.1.4 (2003042910)	Suncorp Network	9	4	0.0
BOQ Mobile (com.bankofqueensland.boq), v1.4.1 (10402)	BOQ	9	6	16.7
SelfWealth (au.com.selfwealth.mobile), v1.0.81 (81)	SelfWealth Limited	6	0	0.0
Exchange Rates (com.despdev.currencyconverter), v3.6 (36)	despdev	4	0	0.0
NAB Mobile Banking (au.com.nab.mobile), v9.46.1 (1278)	NAB	4	1	100.0
US Stock Market (com.usstocks.markets), v4.3 (34)	StocksAndro	3	0	0.0
ING Australia Banking (au.com.ingdirect.android), v8.3.9 (80)	ING Australia	2	0	0.0
UBank Mobile Banking (au.com.ubank.internetbanking), v5.7.0 (183)	NAB	2	0	0.0

D.8.3 Third-Party SDKs

We were able to identify 113 SDKs embedded within the 34 Finance apps. We list the 40 most common SDKs in Table 174,¹⁵² along with the number of Finance apps in which they were detected.

Table 174: The 40 most common SDKs identified within apps in the Finance category.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	30	(88.2%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	28	(82.4%)
Github	Github	Development Aid	17	(50.0%)
Google Gson	Google	Development Aid	17	(50.0%)
picasso	Square Inc.	Development Aid	15	(44.1%)
Google Ads	Google	Advertisement	14	(41.2%)
Crashlytics	Google	Mobile Analytics	13	(38.2%)
Apache Common	The Apache Software Founda- tion	Development Aid	13	(38.2%)
Google DoubleClick	Google	Advertisement	12	(35.3%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	12	(35.3%)
Google Analytics	Google	Mobile Analytics	11	(32.4%)
Glide	Bump Technologies	Development Aid	11	(32.4%)
Google Core Libraries for Java 6+	Google	Development Aid	11	(32.4%)
OkHttp	OkHttp	Development Aid	10	(29.4%)
Volley HTTP library	Google	Development Aid Networking	9	(26.5%)

(Table Continues)

¹⁵²For an explanation of SDKs, see Section 4.1.2.

Table 174 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Fasterxml	FasterXML	Utility	9	(26.5%)
Google Tag Manager	Google	Mobile Analytics	7	(20.6%)
Google Internationalization	Google	Development Aid	7	(20.6%)
Google Protocol Buffers	Google	Development Aid	7	(20.6%)
Bouncy Castle	Bouncy Castles	Development Aid	7	(20.6%)
Google Core Libraries (3rd Party)	Google	Development Aid	7	(20.6%)
Nine Old Androids	Nine Old Androids	Development Aid	7	(20.6%)
Kxml2	Kxml2	Development Aid	6	(17.6%)
SLF4J	SLF4J	Development Aid	5	(14.7%)
EventBus	greenrobot /Markus Junginger	Development Aid	5	(14.7%)
HockeyApp	Microsoft	Mobile Analytics	5	(14.7%)
Apache Http	The Apache Software Founda- tion	Development Aid	5	(14.7%)
Google Play	Google Play	App Market	4	(11.8%)
ZXing ("Zebra Crossing")	ZXing Project	Development Aid	4	(11.8%)
JavaX Annotation API	JavaX Annotation API	Utility	4	(11.8%)
Appdynamics	Appdynamics	Mobile Analytics	4	(11.8%)
Splunk MINT	Splunk	Mobile Analytics	4	(11.8%)
XML Pull	XML Pull	Development Aid	4	(11.8%)
retrofit RESTful Library	Square	Development Aid	4	(11.8%)
Jsoup	Jsoup	Development Aid	4	(11.8%)
KObjects	KObjects	Development Aid	4	(11.8%)
ksoap2	ksoap2	Development Aid	4	(11.8%)
Loopj	James Smith	Development Aid	4	(11.8%)
MaterialProgressBar	MaterialProgressBar	Development Aid	4	(11.8%)
YouTube Android Player API	Google	Development Aid	3	(8.8%)

Several of these SDKs included developer tools, which we characterize as SDKs that provide tools and functionality to app developers which are unlikely to be used for the transmission of user information. As a result, we separately present Table 175, which depicts the 40 most common SDKs with developer tools removed, along with the number of Finance apps in which they were detected.

Table 175: The 40 most common SDKs identified within apps in the Finance category, with developer tools removed.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	30	(88.2%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	28	(82.4%)
Google Ads	Google	Advertisement	14	(41.2%)
Crashlytics	Google	Mobile Analytics	13	(38.2%)
Google DoubleClick	Google	Advertisement	12	(35.3%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	12	(35.3%)
Google Analytics	Google	Mobile Analytics	11	(32.4%)
Volley HTTP library	Google	Development Aid Networking	9	(26.5%)
Google Tag Manager	Google	Mobile Analytics	7	(20.6%)
HockeyApp	Microsoft	Mobile Analytics	5	(14.7%)
Google Play	Google Play	App Market	4	(11.8%)
Appdynamics	Appdynamics	Mobile Analytics	4	(11.8%)
Splunk MINT	Splunk	Mobile Analytics	4	(11.8%)
Omniure	Adobe	Mobile Analytics	3	(8.8%)
Amazon In-App Purchasing	Amazon	Payment	3	(8.8%)
newrelic	New Relic	Mobile Analytics	3	(8.8%)

(Table Continues)

Table 175 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Parse.com	Parse	Mobile Analytics Development Aid	3	(8.8%)
Amplitude	Amplitude	Mobile Analytics	3	(8.8%)
Branch	Branch Metrics	Mobile Analytics Advertisement	3	(8.8%)
Microsoft Appcenter Crashes	Microsoft	Mobile Analytics	3	(8.8%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	2	(5.9%)
getui	getui	Advertisement Mobile Analytics Push Notifications	2	(5.9%)
New Relic	New Relic	Mobile Analytics	2	(5.9%)
Adobe Experience Cloud	Adobe	Mobile Analytics	2	(5.9%)
comscore	Comscore	Mobile Analytics	2	(5.9%)
PayPal	PayPal	Payment	2	(5.9%)
Microsoft Appcenter Analytics	Microsoft	Mobile Analytics	2	(5.9%)
Facebook Ads	Facebook	Advertisement	2	(5.9%)
google-analytics-plugin	Dan Wilson	Mobile Analytics	1	(2.9%)
Amazon Advertisement	Amazon	Advertisement	1	(2.9%)
TalkingData	TalkingData	Mobile Analytics	1	(2.9%)
baidu push service	Baidu	Development Aid Push Notifications	1	(2.9%)
Facebook Analytics	Facebook	Mobile Analytics	1	(2.9%)
Facebook Login	Facebook	Digital Identity Advertisement Mobile Analytics	1	(2.9%)
Facebook Places	Facebook	Map/LBS Advertisement	1	(2.9%)
Facebook Share	Facebook	Social Network Advertisement	1	(2.9%)

(Table Continues)

Table 175 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
		Mobile Analytics		
OutBrain	Outbrain	Advertisement	1	(2.9%)
Flurry	Verizon	Mobile Analytics	1	(2.9%)
ThreatMetrix	LexisNexis	Digital Identity	1	(2.9%)
		Mobile Analytics		
Bugsnag	Bugsnag	Mobile Analytics	1	(2.9%)

D.9 Entertainment Apps

D.9.1 Data Types Transmitted

Apps in the Entertainment category were observed transmitting the data types listed in Table 176 during the testing period.¹⁵³

Data Type	# of Apps	(% of Apps)
AAID	24	(77.4%)
Android ID	14	(45.2%)
GPS Location	3	(9.7%)
Coarse Location	3	(9.7%)
BT Name	3	(9.7%)
Email	2	(6.5%)
Name	1	(3.2%)

Table 176: Data types transmitted by apps in the Entertainment category during the testing period.

¹⁵³For an explanation of these data types, see Section 3.

D.9.1.1 Most Common Hostnames Contacted

Table 177 depicts the top 10 hostnames observed being contacted by Entertainment apps during the testing period, whereas Table 178 depicts the top 10 parent companies corresponding to these hostnames. This data reflects Internet servers that were *contacted* by apps, but does not necessarily mean that they received sensitive user information—we specifically discuss that subset of recipients in Section D.9.1.2.¹⁵⁴ The discrepancy between the two sections is due to the fact that some app transmissions may simply not contain sensitive user information or that its transmission was obfuscated using a method that we did not immediately recognize.

Hostname	Parent Company	# of Apps	(% of Apps)
settings.crashlytics.com	Google	19	(61.3%)
graph.facebook.com	Facebook	15	(48.4%)
firebaseremoteconfig.googleapis.com	Google	10	(32.3%)
s.amazon-adsystem.com	Amazon	5	(16.1%)
googleads.g.doubleclick.net	Google	5	(16.1%)
scontent-syd2-1.xx.fbcdn.net	Facebook	5	(16.1%)
cdn.branch.io	Branch Metrics	5	(16.1%)
secure-dcr.imrworldwide.com	Nielsen	4	(12.9%)
z.moatads.com	Oracle	4	(12.9%)
lh3.googleusercontent.com	Google	4	(12.9%)

Table 177: The top 10 most common hostnames contacted by Entertainment apps during testing.

Company	# of Apps	(% of Apps)
Google	25	(80.6%)
Facebook	16	(51.6%)
AppsFlyer	8	(25.8%)
Amazon	7	(22.6%)
Oracle	5	(16.1%)
Branch Metrics	5	(16.1%)
Microsoft	5	(16.1%)
Liftoff	5	(16.1%)
Nielsen	4	(12.9%)
Twitter	4	(12.9%)

¹⁵⁴We define “user information” in Section 3.

Company	# of Apps	(% of Apps)
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Table 178: The top 10 most common companies contacted by Entertainment apps during testing.

D.9.1.2 Most Common Data Recipients

Table 179 depicts the top 10 data recipients among the Entertainment apps during the testing period. Table 180 lists additional information about the most common data recipients, such as the approximate locations of their servers, IP addresses contacted during testing, and the types of sensitive user information that we observed them receive during the testing period.

Hostname	Parent Company	# of Apps	(% of Apps)
graph.facebook.com	Facebook	15	(48.4%)
s.amazon-adsystem.com	Amazon	5	(16.1%)
secure-dcr.imrworldwide.com	Nielsen	4	(12.9%)
www.facebook.com	Facebook	4	(12.9%)
settings.crashlytics.com	Google	3	(9.7%)
api2.branch.io	Branch Metrics	3	(9.7%)
sdk-android.ad.smaato.net	Smaato	3	(9.7%)
aax-us-east.amazon-adsystem.com	Amazon	3	(9.7%)
t.appsflyer.com	AppsFlyer	3	(9.7%)
ads.mopub.com	Twitter	3	(9.7%)

Table 179: The top 10 most common data recipients from Entertainment apps during testing.

Table 180: The 10 most common recipient hostnames of user information from Entertainment apps during the testing period, along with their IP addresses, company information, and the data types that were observed being transmitted.

Parent Company	Country	IPs	Received Data
graph.facebook.com			
Facebook	United States	157.240.8.18 (US)	AAID
s.amazon-adsystem.com			
Amazon	United States	72.21.206.140 (US) 54.239.17.112 (US) 52.46.130.13 (US)	AAID
secure-dcr.imrworldwide.com			
Nielsen	United States	52.64.49.109 (AU) 52.65.116.110 (AU) 52.65.227.53 (AU)	AAID
www.facebook.com			
Facebook	United States	157.240.8.35 (US)	AAID
ads.mopub.com			
Twitter	United States	192.48.236.9 (US) 192.48.236.12 (US) 192.48.236.10 (US)	GPS Location Coarse Location AAID
mpx.mopub.com			
Twitter	United States	192.48.236.9 (US) 192.48.236.10 (US)	GPS Location Coarse Location AAID
settings.crashlytics.com			
Google	United States	172.217.167.99 (US) 142.250.66.163 (US) 142.250.66.195 (US) 172.217.25.163 (US)	Android ID AAID

(Table Continues)

Table 180 (Continued)

Parent Company	Country	IPs	Received Data
<code>api2.branch.io</code>			
Branch Metrics	United States	99.86.212.117 (US) 13.226.111.122 (US) 13.226.111.60 (US)	Android ID AAID
<code>sdk-android.ad.smaato.net</code>			
Smaato	United States	13.251.5.168 (SG) 52.220.192.118 (SG) 52.74.168.39 (SG)	AAID
<code>aax-us-east.amazon-adsystem.com</code>			
Amazon	United States	52.46.157.171 (US) 52.46.134.16 (US)	AAID

D.9.1.3 Apps Ranked by Number of Recipients

Table 181 ranks the Entertainment apps based on the number of recipients to which we detected each transmit sensitive user information during testing.

Table 181: Entertainment apps ordered by the number of recipients (by unique hostnames and their parent companies) during the testing period.

App	Developer	Installs	Recipients	
			Hostnames	Companies
iFunny –fresh memes, gifs and videos Package Name: mobi.ifunny Version: 6.1.3 (1118884)	iFunny Inc.	10,000,000	22	13
theCHIVE Package Name: com.thechive Version: 2.13.0_Release_Candidate (396)	Chive Media Group LLC	5,000,000	19	13
9GAG: Funny gifs, pics, fresh memes & viral videos Package Name: com.ninegag.android.app Version: 6.82.04r21604-7fafd56a41 (6820400)	9GAG	10,000,000	9	8
7plus Package Name: com.swm.live Version: 4.14.1 (53637)	Seven West Media	1,000,000	8	6
BuzzVideo: Watch something great Package Name: com.ss.android.article.topbuzzvideo.en Version: 10.1.7.01 (101701)	TopBuzz	10,000,000	16	5
MISTPLAY: Gift Cards & Rewards For Playing Games Package Name: com.mistplay.mistplay Version: 4.61 (4267722)	MISTPLAY	5,000,000	7	5
ABC iview Package Name: au.net.abc.iview Version: 4.8.1 (3081)	Australian Broadcasting Corporation	1,000,000	5	5
SBS On Demand Package Name: com.sbs.ondemand.android Version: v3.4.0 (10381)	SBS Corporation	1,000,000	7	5
Twitch: Livestream Multiplayer Games & Esports Package Name: tv.twitch.android.app Version: 9.0.2 (900020)	Twitch Interactive, Inc.	100,000,000	9	4
Tubi - Free Movies & TV Shows Package Name: com.tubitv Version: 4.1.2 (407)	Tubi TV	50,000,000	4	4
9Now Package Name: au.com.mi9.jumpin.app Version: 4.6.5 (40605125)	NINE NETWORK AUSTRALIA PTY LTD	1,000,000	6	4

(Table Continues)

Table 181 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
IMDb Movies & TV Shows: Trailers, Reviews, Tickets Package Name: com.imdb.mobile Version: 8.1.7.108170102 (108170102)	IMDb	100,000,000	3	3
AnimeLab - Watch Anime Free Package Name: com.animelab.android.handset Version: 2.6.7 (193)	Madman Entertainment	100,000	3	3
FanPlus - All About the Kpop World for Fans Package Name: com.photocard.allstar Version: 1.3.1 (83)	Team Fan	100,000	4	3
Pictophile: Meme Maker & Generator Package Name: com.voodooocoding.lolbucket Version: 2.0.3 (38)	Voodoo Coding	50,000	6	3
Flash Keyboard Emoji Package Name: com.dotc.latin.ime.tap Version: 1.0.1101.0221 (1101)	Flashkeyboard Team	10,000,000	5	2
Stan Package Name: au.com.stan.and Version: 3.21.0 (35632)	Stan Entertainment Pty Ltd	1,000,000	2	2
Bigfoot - FREE in-game assistant for mobile player Package Name: us.ozteam.bigfoot Version: 2.0.56.2000 (2002000372)	Oz Interactive	1,000,000	4	2
Tap Roulette ++Shock my Friend Package Name: com.TAP.TapTapTap Version: 2.8 (7)	Go best	1,000,000	6	2
TruyenCv - Đọc truyện convert Package Name: com.dragon.tcv Version: 1.0.5 (7)	Truyện Convert	50,000	3	2
TV Guide Australia: AusTV Package Name: io.austv.client.android Version: 1.9 (15)	Sladjan Ilic	10,000	2	2
Amazon Prime Video Package Name: com.amazon.avod.thirdpartyclient Version: 3.0.269.106747 (269106747)	Amazon Mobile LLC	100,000,000	2	1
Xbox Package Name: com.microsoft.xboxone.smartglass Version: 2002.0229.0010 (200229000)	Microsoft Corporation	50,000,000	1	1
Disney+ Package Name: com.disney.disneyplus Version: 1.5.2 (215640)	Disney	10,000,000	2	1
Auto- Athkar for muslims Package Name: com.revanen.athkar	Kunooz.	10,000,000	2	1

(Table Continues)

Table 181 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Version: 8.5 (75) Astrology Answers - Horoscopes & More Package Name: com.aa.astrology Version: 3.0 (7)	Astrology Answers	5,000	1	1
Netflix Package Name: com.netflix.mediaclient Version: 7.56.1 build 23 34861 (34861)	Netflix, Inc.	500,000,000	0	0
Foxtel Go Package Name: au.com.foxtel.Go Version: 5.7.3 (5703)	FOXTEL	1,000,000	0	0
FileSun Official - Free movies, dramas, anime Package Name: com.is.filesun.version4 Version: 3.05 (19)	파일썬	100,000	0	0
Radio Nicaragua Package Name: com.radio.nicaragua Version: 4.12 (102)	User One Studio	50,000	0	0
Universe Tv Player - Tv Box Package Name: com.universetvplayertvbox.universetvplayertvboxiptvbox Version: 2.2.2 (62)	EG Developers	10,000	0	0

D.9.1.4 Popular Apps Transmitting Each Data Type

For each of these data types, Table 182 lists the top 5 most popular Entertainment apps that we observed transmitting them during testing.¹⁵⁵

Table 182: The top 5 Entertainment apps that we detected transmitting each data type during the testing period.

Data Type	Top 5 Apps	Developer	# of Installs
AAID	IMDb Movies & TV Shows: Trailers, Reviews, Tickets (com.imdb.mobile), v8.1.7.108170102 (108170102)	IMDb	100,000,000
	Twitch: Livestream Multiplayer Games & Esports (tv.twitch.android.app), v9.0.2 (900020)	Twitch Interactive, Inc.	100,000,000
	Amazon Prime Video (com.amazon.avod.thirdpartyclient), v3.0.269.106747 (269106747)	Amazon Mobile LLC	100,000,000
	Xbox (com.microsoft.xboxone.smartglass), v2002.0229.0010 (200229000)	Microsoft Corporation	50,000,000
	Tubi - Free Movies & TV Shows (com.tubitv), v4.1.2 (407)	Tubi TV	50,000,000
Android ID	Tubi - Free Movies & TV Shows (com.tubitv), v4.1.2 (407)	Tubi TV	50,000,000
	BuzzVideo: Watch something great (com.ss.android.article.topbuzzvideo.en), v10.1.7.01 (101701)	TopBuzz	10,000,000
	Auto- Athkar for muslims (com.revanen.athkar), v8.5 (75)	Kunooz.	10,000,000
	MISTPLAY: Gift Cards & Rewards For Playing Games (com.mistplay.mistplay), v4.61 (4267722)	MISTPLAY	5,000,000
	theCHIVE (com.thechive), v2.13.0_Release_Candidate (396)	Chive Media Group LLC	5,000,000
GPS Location	BuzzVideo: Watch something great (com.ss.android.article.topbuzzvideo.en), v10.1.7.01 (101701)	TopBuzz	10,000,000
	theCHIVE (com.thechive), v2.13.0_Release_Candidate (396)	Chive Media Group LLC	5,000,000
	7plus (com.swm.live), v4.14.1 (53637)	Seven West Media	1,000,000
Coarse Location	BuzzVideo: Watch something great	TopBuzz	10,000,000

(Table Continues)

¹⁵⁵Popularity is determined by the number of reported installs in the Google Play Store.

Table 182 (Continued)

Data Type	Top 5 Apps	Developer	# of Installs
	(com.ss.android.article.topbuzzvideo.en), v10.1.7.01 (101701) theCHIVE (com.thechive), v2.13.0_Release_Candidate (396) 7plus (com.swm.live), v4.14.1 (53637)	Chive Media Group LLC Seven West Media	5,000,000 1,000,000
BT Name	MISTPLAY: Gift Cards & Rewards For Playing Games (com.mistplay.mistplay), v4.61 (4267722) Stan (au.com.stan.and), v3.21.0 (35632) Tap Roulette ++Shock my Friend (com.TAP.TapTapTap), v2.8 (7)	MISTPLAY Stan Entertainment Pty Ltd Go best	5,000,000 1,000,000 1,000,000
Email	Twitch: Livestream Multiplayer Games & Esports (tv.twitch.android.app), v9.0.2 (900020) MISTPLAY: Gift Cards & Rewards For Playing Games (com.mistplay.mistplay), v4.61 (4267722)	Twitch Interactive, Inc. MISTPLAY	100,000,000 5,000,000
Name	MISTPLAY: Gift Cards & Rewards For Playing Games (com.mistplay.mistplay), v4.61 (4267722)	MISTPLAY	5,000,000

Table 183 lists the 5 most popular Entertainment apps that transmitted the most data types during the testing period, whereas Table 184 lists the 5 most popular Entertainment apps that transmitted the fewest data types during the testing period.

Top 5 Apps	Developer	# of Installs	Data Types
MISTPLAY: Gift Cards & Rewards For Playing Games (com.mistplay.mistplay), v4.61 (4267722)	MISTPLAY	5,000,000	5
BuzzVideo: Watch something great (com.ss.android.article.topbuzzvideo.en), v10.1.7.01 (101701)	TopBuzz	10,000,000	4
theCHIVE (com.thechive), v2.13.0_Release_Candidate (396)	Chive Media Group LLC	5,000,000	4
7plus (com.swm.live), v4.14.1 (53637)	Seven West Media	1,000,000	4
Stan (au.com.stan.and), v3.21.0 (35632)	Stan Entertainment Pty Ltd	1,000,000	3

Table 183: The top 5 Entertainment apps that transmitted the most data types during testing.

Top 5 Apps	Developer	# of Installs	Data Types
Netflix (com.netflix.mediaclient), v7.56.1 build 23 34861 (34861)	Netflix, Inc.	500,000,000	0
Foxtel Go (au.com.foxtel.Go), v5.7.3 (5703)	FOXTEL	1,000,000	0
FileSun Official - Free movies, dramas, anime (com.is.filesun.version4), v3.05 (19)	파일썬	100,000	0
Radio Nicaragua (com.radio.nicaragua), v4.12 (102)	User One Studio	50,000	0
Universe Tv Player - Tv Box (com.universetvplayertvbox.universetvplayertvboxiptvbox), v2.2.2 (62)	EG Developers	10,000	0

Table 184: The top 5 Entertainment apps that transmitted the fewest data types during testing.

D.9.2 App Permissions

Apps in the Entertainment category requested the dangerous permissions listed in Table 185.¹⁵⁶

Data Type	# of Apps	(% of Apps)
WRITE_EXTERNAL_STORAGE	20	(64.5%)
READ_EXTERNAL_STORAGE	18	(58.1%)
ACCESS_COARSE_LOCATION	12	(38.7%)
READ_PHONE_STATE	11	(35.5%)
GET_ACCOUNTS	10	(32.3%)
ACCESS_FINE_LOCATION	10	(32.3%)
CAMERA	8	(25.8%)
RECORD_AUDIO	5	(16.1%)
READ_CONTACTS	2	(6.5%)
WRITE_CALENDAR	1	(3.2%)
READ_CALENDAR	1	(3.2%)
ACCESS_BACKGROUND_LOCATION	1	(3.2%)
CALL_PHONE	1	(3.2%)

Table 185: Dangerous permissions requested by apps in the Entertainment category.

¹⁵⁶For an explanation of dangerous permissions, see Section 4.3.

D.9.2.1 Popular Apps Requesting Dangerous Permissions For each of these permissions, Table 186 lists the top 5 most popular apps that we observed requesting dangerous permissions during testing.¹⁵⁷

Table 186: The 5 most popular Entertainment apps that requested each dangerous permission.

Permission	Top 5 Apps	Developer	# of Installs
WRITE_EXTERNAL_STORAGE			
	Amazon Prime Video (com.amazon.avod.thirdpartyclient), (269106747)	v3.0.269.106747 Amazon Mobile LLC	100,000,000
	Xbox (com.microsoft.xboxone.smartglass), (200229000)	v2002.0229.0010 Microsoft Corporation	50,000,000
	Tubi - Free Movies & TV Shows (com.tubitv), v4.1.2 (407)	Tubi TV	50,000,000
	BuzzVideo: Watch something great (com.ss.android.article.topbuzzvideo.en), v10.1.7.01 (101701)	TopBuzz	10,000,000
	9GAG: Funny gifs, pics, fresh memes & viral videos (com.ninegag.android.app), (6820400)	v6.82.04r21604-7fafd56a41 9GAG	10,000,000
READ_EXTERNAL_STORAGE			
	Twitch: Livestream Multiplayer Games & Esports (tv.twitch.android.app), v9.0.2 (900020)	Twitch Interactive, Inc.	100,000,000
	Amazon Prime Video (com.amazon.avod.thirdpartyclient), (269106747)	v3.0.269.106747 Amazon Mobile LLC	100,000,000
	Xbox (com.microsoft.xboxone.smartglass), (200229000)	v2002.0229.0010 Microsoft Corporation	50,000,000
	Tubi - Free Movies & TV Shows (com.tubitv), v4.1.2 (407)	Tubi TV	50,000,000
	BuzzVideo: Watch something great (com.ss.android.article.topbuzzvideo.en), v10.1.7.01 (101701)	TopBuzz	10,000,000
ACCESS_COARSE_LOCATION			
	IMDb Movies & TV Shows: Trailers, Reviews, Tickets (com.imdb.mobile), v8.1.7.108170102 (108170102)	IMDb	100,000,000
	Amazon Prime Video (com.amazon.avod.thirdpartyclient), (269106747)	v3.0.269.106747 Amazon Mobile LLC	100,000,000
	Tubi - Free Movies & TV Shows (com.tubitv), v4.1.2 (407)	Tubi TV	50,000,000

(Table Continues)

¹⁵⁷Popularity is determined by the number of reported installs in the Google Play Store.

Table 186 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	BuzzVideo: Watch something great (com.ss.android.article.topbuzzvideo.en), v10.1.7.01 (101701)	TopBuzz	10,000,000
	Auto- Athkar for muslims (com.revanen.athkar), v8.5 (75)	Kunooz.	10,000,000
READ_PHONE_STATE			
	Amazon Prime Video (com.amazon.avod.thirdpartyclient), v3.0.269.106747 (269106747)	Amazon Mobile LLC	100,000,000
	Xbox (com.microsoft.xboxone.smartglass), v2002.0229.0010 (200229000)	Microsoft Corporation	50,000,000
	Tubi - Free Movies & TV Shows (com.tubitv), v4.1.2 (407)	Tubi TV	50,000,000
	theCHIVE (com.thechive), v2.13.0_Release_Candidate (396)	Chive Media Group LLC	5,000,000
	7plus (com.swm.live), v4.14.1 (53637)	Seven West Media	1,000,000
GET_ACCOUNTS			
	IMDb Movies & TV Shows: Trailers, Reviews, Tickets (com.imdb.mobile), v8.1.7.108170102 (108170102)	IMDb	100,000,000
	Amazon Prime Video (com.amazon.avod.thirdpartyclient), v3.0.269.106747 (269106747)	Amazon Mobile LLC	100,000,000
	Xbox (com.microsoft.xboxone.smartglass), v2002.0229.0010 (200229000)	Microsoft Corporation	50,000,000
	9GAG: Funny gifs, pics, fresh memes & viral videos (com.ninegag.android.app), v6.82.04r21604-7fafd56a41 (6820400)	9GAG	10,000,000
	Auto- Athkar for muslims (com.revanen.athkar), v8.5 (75)	Kunooz.	10,000,000
ACCESS_FINE_LOCATION			
	Amazon Prime Video (com.amazon.avod.thirdpartyclient), v3.0.269.106747 (269106747)	Amazon Mobile LLC	100,000,000
	BuzzVideo: Watch something great (com.ss.android.article.topbuzzvideo.en), v10.1.7.01 (101701)	TopBuzz	10,000,000
	Flash Keyboard Emoji (com.dotc.latin.ime.tap), v1.0.1101.0221 (1101)	Flashkeyboard Team	10,000,000
	iFunny -fresh memes, gifs and videos (mobi.ifunny), v6.1.3 (1118884)	iFunny Inc.	10,000,000
	theCHIVE	Chive Media Group LLC	5,000,000

(Table Continues)

Table 186 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(com.thechive), v2.13.0_Release_Candidate (396)		
CAMERA			
	Twitch: Livestream Multiplayer Games & Esports (tv.twitch.android.app), v9.0.2 (900020)	Twitch Interactive, Inc.	100,000,000
	Xbox (com.microsoft.xboxone.smartglass), v2002.0229.0010 (200229000)	Microsoft Corporation	50,000,000
	Tubi - Free Movies & TV Shows (com.tubitv), v4.1.2 (407)	Tubi TV	50,000,000
	BuzzVideo: Watch something great (com.ss.android.article.topbuzzvideo.en), v10.1.7.01 (101701)	TopBuzz	10,000,000
	Flash Keyboard Emoji (com.dotc.latin.ime.tap), v1.0.1101.0221 (1101)	Flashkeyboard Team	10,000,000
RECORD_AUDIO			
	Twitch: Livestream Multiplayer Games & Esports (tv.twitch.android.app), v9.0.2 (900020)	Twitch Interactive, Inc.	100,000,000
	Xbox (com.microsoft.xboxone.smartglass), v2002.0229.0010 (200229000)	Microsoft Corporation	50,000,000
	9GAG: Funny gifs, pics, fresh memes & viral videos (com.ninegag.android.app), v6.82.04r21604-7fafd56a41 (6820400)	9GAG	10,000,000
	Bigfoot - FREE in-game assistant for mobile player (us.ozteam.bigfoot), v2.0.56.2000 (2002000372)	Oz Interactive	1,000,000
	FanPlus - All About the Kpop World for Fans (com.photocard.allstar), v1.3.1 (83)	Team Fan	100,000
READ_CONTACTS			
	Xbox (com.microsoft.xboxone.smartglass), v2002.0229.0010 (200229000)	Microsoft Corporation	50,000,000
	MISTPLAY: Gift Cards & Rewards For Playing Games (com.mistplay.mistplay), v4.61 (4267722)	MISTPLAY	5,000,000
WRITE_CALENDAR			
	TV Guide Australia: AusTV (io.austv.client.android), v1.9 (15)	Sladjan Ilic	10,000
READ_CALENDAR			
	TV Guide Australia: AusTV (io.austv.client.android), v1.9 (15)	Sladjan Ilic	10,000
ACCESS_BACKGROUND_LOCATION			
	theCHIVE	Chive Media Group LLC	5,000,000

(Table Continues)

Table 186 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(com.thehive), v2.13.0_Release_Candidate (396)		
CALL_PHONE	FanPlus - All About the Kpop World for Fans (com.photocard.allstar), v1.3.1 (83)	Team Fan	100,000

Table 187 lists the 5 most popular Entertainment apps that requested the most permissions, whereas Table 188 lists the 5 most popular Entertainment apps that requested the fewest permissions.

Top 5 Apps	Developer	# of Installs	Permissions
Flash Keyboard Emoji (com.dotc.latin.ime.tap), v1.0.1101.0221 (1101)	Flashkeyboard Team	10,000,000	27
BuzzVideo: Watch something great (com.ss.android.article.topbuzzvideo.en), v10.1.7.01 (101701)	TopBuzz	10,000,000	23
Bigfoot - FREE in-game assistant for mobile player (us.ozteam.bigfoot), v2.0.56.2000 (2002000372)	Oz Interactive	1,000,000	23
Xbox (com.microsoft.xboxone.smartglass), v2002.0229.0010 (200229000)	Microsoft Corporation	50,000,000	20
Amazon Prime Video (com.amazon.avod.thirdpartyclient), v3.0.269.106747 (269106747)	Amazon Mobile LLC	100,000,000	19

Table 187: The 5 most popular Entertainment apps that requested the most permissions.

Top 5 Apps	Developer	# of Installs	Permissions
Netflix (com.netflix.mediaclient), v7.56.1 build 23 34861 (34861)	Netflix, Inc.	500,000,000	3
TruyenCv - Đọc truyện convert (com.dragon.tcv), v1.0.5 (7)	Truyện Convert	50,000	3
Tap Roulette ++Shock my Friend (com.TAP.TapTapTap), v2.8 (7)	Go best	1,000,000	4
Disney+ (com.disney.disneyplus), v1.5.2 (215640)	Disney	10,000,000	5
SBS On Demand (com.sbs.ondemand.android), vv3.4.0 (10381)	SBS Corporation	1,000,000	5

Table 188: The 5 most popular Entertainment apps that requested the least number of permissions.

D.9.2.2 Permission Usage While the previous subsection depicted the dangerous permissions *requested* by the apps that were tested, Table 189 lists the Entertainment apps based on the dangerous permissions that were observed being *used* during the testing period.

Table 189: Entertainment apps based on total number of permissions requested, the number of those that are considered “dangerous,” and the percentage of those dangerous permissions that were used during testing.

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
Flash Keyboard Emoji (com.dotc.latin.ime.tap), v1.0.1101.0221 (1101)	Flashkeyboard Team	27	5	0.0
BuzzVideo: Watch something great (com.ss.android.article.topbuzzvideo.en), v10.1.7.01 (101701)	TopBuzz	23	5	0.0
Bigfoot - FREE in-game assistant for mobile player (us.ozteam.bigfoot), v2.0.56.2000 (2002000372)	Oz Interactive	23	7	0.0
Xbox (com.microsoft.xboxone.smartglass), v2002.0229.0010 (200229000)	Microsoft Corporation	20	7	0.0
Amazon Prime Video (com.amazon.avod.thirdpartyclient), v3.0.269.106747 (269106747)	Amazon Mobile LLC	19	6	0.0
FanPlus - All About the Kpop World for Fans (com.photocard.allstar), v1.3.1 (83)	Team Fan	19	9	0.0
iFunny –fresh memes, gifs and videos (mobi.ifunny), v6.1.3 (1118884)	iFunny Inc.	15	5	20.0
MISTPLAY: Giff Cards & Rewards For Playing Games (com.mistplay.mistplay), v4.61 (4267722)	MISTPLAY	14	4	0.0
FileSun Official - Free movies, dramas, anime (com.is.filesun.version4), v3.05 (19)	파일썬	13	2	0.0
Universe Tv Player - Tv Box (com.universetvplayertvbox.universetvplayertvboxiptvbox), v2.2.2 (62)	EG Developers	12	2	0.0
Tubi - Free Movies & TV Shows (com.tubitv), v4.1.2 (407)	Tubi TV	12	5	0.0
theCHIVE (com.thechive), v2.13.0_Release_Candidate (396)	Chive Media Group LLC	12	7	28.6
9GAG: Funny gifs, pics, fresh memes & viral videos (com.ninegag.android.app), v6.82.04r21604-7fafd56a41 (6820400)	9GAG	11	4	0.0
TV Guide Australia: AusTV (io.austv.client.android), v1.9 (15)	Sladjan Illic	11	5	0.0

(Table Continues)

Table 189 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
Auto- Athkar for muslims (com.revanen.athkar), v8.5 (75)	Kunooz.	11	2	0.0
9Now (au.com.mi9.jumpin.app), v4.6.5 (40605125)	NINE NETWORK AUSTRALIA PTY LTD	10	4	25.0
IMDb Movies & TV Shows: Trailers, Reviews, Tickets (com.imdb.mobile), v8.1.7.108170102 (108170102)	IMDb	9	2	0.0
Stan (au.com.stan.and), v3.21.0 (35632)	Stan Entertainment Pty Ltd	9	2	0.0
Twitch: Livestream Multiplayer Games & Esports (tv.twitch.android.app), v9.0.2 (900020)	Twitch Interactive, Inc.	9	3	0.0
Astrology Answers - Horoscopes & More (com.aa.astrology), v3.0 (7)	Astrology Answers	9	4	25.0
7plus (com.swm.live), v4.14.1 (53637)	Seven West Media	9	4	50.0
Foxtel Go (au.com.foxtel.Go), v5.7.3 (5703)	FOXTEL	8	2	0.0
Radio Nicaragua (com.radio.nicaragua), v4.12 (102)	User One Studio	8	2	0.0
AnimeLab - Watch Anime Free (com.animelab.android.handset), v2.6.7 (193)	Madman Entertainment	7	0	0.0
ABC iview (au.net.abc.iview), v4.8.1 (3081)	Australian Broadcasting Corporation	6	0	0.0
Pictophile: Meme Maker & Generator (com.voodooocoding.lolbucket), v2.0.3 (38)	Voodoo Coding	6	2	0.0
Disney+ (com.disney.disneyplus), v1.5.2 (215640)	Disney	5	0	0.0
SBS On Demand (com.sbs.ondemand.android), vv3.4.0 (10381)	SBS Corporation	5	0	0.0
Tap Roulette ++Shock my Friend (com.TAP.TapTapTap), v2.8 (7)	Go best	4	0	0.0
Netflix (com.netflix.mediaclient), v7.56.1 build 23 34861 (34861)	Netflix, Inc.	3	0	0.0
TruyenCv - Đọc truyện convert (com.dragon.tcv), v1.0.5 (7)	Truyện Convert	3	0	0.0

D.9.3 Third-Party SDKs

We were able to identify 133 SDKs embedded within the 31 Entertainment apps. We list the 40 most common SDKs in Table 190,¹⁵⁸ along with the number of Entertainment apps in which they were detected.

Table 190: The 40 most common SDKs identified within apps in the Entertainment category.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	28	(90.3%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	27	(87.1%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	26	(83.9%)
Crashlytics	Google	Mobile Analytics	20	(64.5%)
Glide	Bump Technologies	Development Aid	19	(61.3%)
Google Gson	Google	Development Aid	18	(58.1%)
Google Ads	Google	Advertisement	17	(54.8%)
Facebook Login	Facebook	Digital Identity Advertisement Mobile Analytics	14	(45.2%)
Github	Github	Development Aid	14	(45.2%)
Google DoubleClick	Google	Advertisement	14	(45.2%)
Facebook Share	Facebook	Social Network Advertisement Mobile Analytics	13	(41.9%)
Facebook Analytics	Facebook	Mobile Analytics	12	(38.7%)
Google Analytics	Google	Mobile Analytics	12	(38.7%)

(Table Continues)

¹⁵⁸For an explanation of SDKs, see Section 4.1.2.

Table 190 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Core Libraries for Java 6+	Google	Development Aid	11	(35.5%)
ZXing ('Zebra Crossing')	ZXing Project	Development Aid	11	(35.5%)
Google Tag Manager	Google	Mobile Analytics	10	(32.3%)
Google Play	Google Play	App Market	10	(32.3%)
Facebook Ads	Facebook	Advertisement	10	(32.3%)
Volley HTTP library	Google	Development Aid Networking	9	(29.0%)
Apache Common	The Apache Software Founda- tion	Development Aid	8	(25.8%)
picasso	Square Inc.	Development Aid	7	(22.6%)
JavaX Annotation API	JavaX Annotation API	Utility	7	(22.6%)
Amazon AWS	Amazon	Development Aid	7	(22.6%)
Moat	Oracle	Mobile Analytics	7	(22.6%)
Facebook Places	Facebook	Map/LBS Advertisement	7	(22.6%)
Google Protocol Buffers	Google	Development Aid	6	(19.4%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	6	(19.4%)
YouTube Android Player API	Google	Development Aid	6	(19.4%)
Amazon Advertisement	Amazon	Advertisement	5	(16.1%)
Fasterxml	FasterXML	Utility	5	(16.1%)
Google Core Libraries (3rd Party)	Google	Development Aid	5	(16.1%)
Integral Ad Science	Integral Ad Science Inc.	Mobile Analytics Advertisement AdFraud	5	(16.1%)
Json org	Json org	Development Aid	5	(16.1%)
getui	getui	Advertisement Mobile Analytics Push Notifications	5	(16.1%)
Branch	Branch Metrics	Mobile Analytics	5	(16.1%)

(Table Continues)

Table 190 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
		Advertisement		
MoPub	Twitter	Advertisement	5	(16.1%)
hamcrest	Hamcrest	Development Aid	4	(12.9%)
comscore	Comscore	Mobile Analytics	4	(12.9%)
SLF4J	SLF4J	Development Aid	4	(12.9%)
MaterialProgressBar	MaterialProgressBar	Development Aid	4	(12.9%)

Several of these SDKs included developer tools, which we characterize as SDKs that provide tools and functionality to app developers which are unlikely to be used for the transmission of user information. As a result, we separately present Table 191, which depicts the 40 most common SDKs with developer tools removed, along with the number of Entertainment apps in which they were detected.

Table 191: The 40 most common SDKs identified within apps in the Entertainment category, with developer tools removed.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	28	(90.3%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	27	(87.1%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	26	(83.9%)
Crashlytics	Google	Mobile Analytics	20	(64.5%)
Google Ads	Google	Advertisement	17	(54.8%)
Facebook Login	Facebook	Digital Identity	14	(45.2%)

(Table Continues)

Table 191 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
		Advertisement Mobile Analytics		
Google DoubleClick	Google	Advertisement	14	(45.2%)
Facebook Share	Facebook	Social Network Advertisement Mobile Analytics	13	(41.9%)
Facebook Analytics	Facebook	Mobile Analytics	12	(38.7%)
Google Analytics	Google	Mobile Analytics	12	(38.7%)
Google Tag Manager	Google	Mobile Analytics	10	(32.3%)
Google Play	Google Play	App Market	10	(32.3%)
Facebook Ads	Facebook	Advertisement	10	(32.3%)
Volley HTTP library	Google	Development Aid Networking	9	(29.0%)
Moat	Oracle	Mobile Analytics	7	(22.6%)
Facebook Places	Facebook	Map/LBS Advertisement	7	(22.6%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	6	(19.4%)
Amazon Advertisement	Amazon	Advertisement	5	(16.1%)
Integral Ad Science	Integral Ad Science Inc.	Mobile Analytics Advertisement AdFraud	5	(16.1%)
getui	getui	Advertisement Mobile Analytics Push Notifications	5	(16.1%)
Branch	Branch Metrics	Mobile Analytics Advertisement	5	(16.1%)
MoPub	Twitter	Advertisement	5	(16.1%)
comscore	Comscore	Mobile Analytics	4	(12.9%)
Applovin	AppLovin	Advertisement	4	(12.9%)
Unity3D	Unity Technologies	Game Engine	4	(12.9%)

(Table Continues)

Table 191 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
		Mobile Analytics Advertisement		
Unity3d Ads	Unity Technologies	Advertisement	4	(12.9%)
Nielsen	Nielsen	Mobile Analytics	3	(9.7%)
Amazon Analytics	Amazon	Mobile Analytics	3	(9.7%)
Tencent Wechat	Tencent	Social Network	3	(9.7%)
IronSource	IronSource	Advertisement Mobile Analytics	3	(9.7%)
Smaato	Smaato	Advertisement LBS	3	(9.7%)
Vungle	Vungle	Advertisement	3	(9.7%)
Fyber	Fyber	Advertisement	3	(9.7%)
Gigya	SAP	Mobile Analytics	2	(6.5%)
Snowplow	Snowplow Analytics	Mobile Analytics	2	(6.5%)
Bugsnag	Bugsnag	Mobile Analytics	2	(6.5%)
Flurry	Verizon	Mobile Analytics	2	(6.5%)
Microsoft Appcenter Analytics	Microsoft	Mobile Analytics	2	(6.5%)
Microsoft Appcenter Crashes	Microsoft	Mobile Analytics	2	(6.5%)
AdColony	AdColony	Advertisement	2	(6.5%)

D.10 Music & Audio Apps

D.10.1 Data Types Transmitted

Apps in the Music & Audio category were observed transmitting the data types listed in Table 192 during the testing period.¹⁵⁹

Data Type	# of Apps	(% of Apps)
AAID	18	(64.3%)
Android ID	15	(53.6%)
Email	2	(7.1%)
Name	1	(3.6%)
GPS Location	1	(3.6%)
Coarse Location	1	(3.6%)
GSF ID	1	(3.6%)

Table 192: Data types transmitted by apps in the Music & Audio category during the testing period.

¹⁵⁹For an explanation of these data types, see Section 3.

D.10.1.1 Most Common Hostnames Contacted

Table 193 depicts the top 10 hostnames observed being contacted by Music & Audio apps during the testing period, whereas Table 194 depicts the top 10 parent companies corresponding to these hostnames. This data reflects Internet servers that were *contacted* by apps, but does not necessarily mean that they received sensitive user information—we specifically discuss that subset of recipients in Section D.10.1.2.¹⁶⁰ The discrepancy between the two sections is due to the fact that some app transmissions may simply not contain sensitive user information or that its transmission was obfuscated using a method that we did not immediately recognize.

Hostname	Parent Company	# of Apps	(% of Apps)
settings.crashlytics.com	Google	17	(60.7%)
graph.facebook.com	Facebook	16	(57.1%)
googleads.g.doubleclick.net	Google	15	(53.6%)
firebaseremoteconfig.googleapis.com	Google	13	(46.4%)
pagead2.googleadservices.com	Google	13	(46.4%)
tpc.google syndication.com	Google	12	(42.9%)
lh3.googleusercontent.com	Google	11	(39.3%)
www.googletagservices.com	Google	9	(32.1%)
fonts.googleapis.com	Google	9	(32.1%)
fonts.gstatic.com	Google	9	(32.1%)

Table 193: The top 10 most common hostnames contacted by Music & Audio apps during testing.

Company	# of Apps	(% of Apps)
Google	25	(89.3%)
Facebook	18	(64.3%)
Verizon	6	(21.4%)
Liftoff	5	(17.9%)
Branch Metrics	4	(14.3%)
Oracle	4	(14.3%)
Amazon	3	(10.7%)
comScore	3	(10.7%)
The E.W. Scripps Company	3	(10.7%)
Unity Technologies	3	(10.7%)

¹⁶⁰We define “user information” in Section 3.

Company	# of Apps	(% of Apps)
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Table 194: The top 10 most common companies contacted by Music & Audio apps during testing.

D.10.1.2 Most Common Data Recipients

Table 195 depicts the top 10 data recipients among the Music & Audio apps during the testing period. Table 196 lists additional information about the most common data recipients, such as the approximate locations of their servers, IP addresses contacted during testing, and the types of sensitive user information that we observed them receive during the testing period.

Hostname	Parent Company	# of Apps	(% of Apps)
graph.facebook.com	Facebook	13	(46.4%)
www.facebook.com	Facebook	4	(14.3%)
data.flurry.com	Verizon	4	(14.3%)
api2.branch.io	Branch Metrics	3	(10.7%)
impression-east.liftoff.io	Liftoff	3	(10.7%)
publisher-config.unityads.unity3d.com	Unity Technologies	3	(10.7%)
auction.unityads.unity3d.com	Unity Technologies	3	(10.7%)
ad.crowdctrl.net	Lotame	2	(7.1%)
b.scorecardresearch.com	comScore	2	(7.1%)
onesignal.com	OneSignal	2	(7.1%)

Table 195: The top 10 most common data recipients from Music & Audio apps during testing.

Table 196: The 10 most common recipient hostnames of user information from Music apps during the testing period, along with their IP addresses, company information, and the data types that were observed being transmitted.

Parent Company	Country	IPs	Received Data
<code>graph.facebook.com</code>			
Facebook	United States	157.240.8.18 (US)	AAID
<code>data.flurry.com</code>			
Verizon	United States	115.178.9.19 (HK) 115.178.9.18 (HK)	Android ID AAID
<code>www.facebook.com</code>			
Facebook	United States	157.240.8.35 (US)	AAID
<code>api2.branch.io</code>			
Branch Metrics	United States	13.224.175.84 (US) 99.86.212.51 (US) 13.226.111.100 (US)	Android ID AAID
<code>impression-east.liftoff.io</code>			
Liftoff	United States	18.233.123.55 (US)	AAID
<code>publisher-config.unityads.unity3d.com</code>			
Unity Technologies	United States	35.244.185.185 (US)	AAID
<code>auction.unityads.unity3d.com</code>			
Unity Technologies	United States	35.224.94.229 (US) 104.198.47.225 (US) 35.223.159.56 (US)	AAID
<code>ad.crowdctrl.net</code>			
Lotame	United States	13.237.167.116 (AU) 3.105.183.35 (AU)	AAID

(Table Continues)

Table 196 (Continued)

Parent Company	Country	IPs	Received Data
b.scorecardresearch.com			
comScore	United States	23.62.156.217 (US) 23.62.156.211 (US)	AAID
onesignal.com			
OneSignal	United States	104.18.225.52 (US) 104.18.226.52 (US)	AAID

D.10.1.3 Apps Ranked by Number of Recipients

Table 197 ranks the Music & Audio apps based on the number of recipients to which we detected each transmit sensitive user information during testing.

Table 197: Music & Audio apps ordered by the number of recipients (by unique hostnames and their parent companies) during the testing period.

App	Developer	Installs	Recipients	
			Hostnames	Companies
Audiomack: Download New Music Offline Free Package Name: com.audiomack Version: 5.4.5 (7056)	Audiomack	10,000,000	34	16
iHeartRadio: Radio, Podcasts & Music On Demand Package Name: com.clearchannel.heartradio.controller Version: 9.19.0 (709190003)	iHeartMedia, Inc.	50,000,000	11	10
TuneIn Radio: Live Sports, News, Music & Podcasts Package Name: tunein.player Version: 24.2 (261561)	TuneIn Inc	100,000,000	9	6
Stitcher - Podcast Player Package Name: com.stitcher.app Version: 4.8.0 (1463)	Stitcher, Inc	5,000,000	7	6
Extra-High Volume Booster & Loud Speaker Booster Package Name: com.extravolumebooster.soundamplifier.equalizer Version: 2.1.2 (6)	Cetin FunLab	500,000	6	5
Rocker Music Player 2020 - PowerAudio & MP3 Player Package Name: com.ginger.musicplayer Version: 1.0.9 (9)	Ginger Team	50,000	9	5
Musixmatch - Lyrics for your music Package Name: com.musixmatch.android.lyrify Version: 7.5.9 (2020050401)	Musixmatch	50,000,000	4	4
BG Player Package Name: com.music.bgplayer Version: 4.0.12 (26)	Yossef Faroh Zada	1,000,000	5	4
Radio Mexico: Online Radio, Internet Radio Package Name: com.appmind.radios.mx Version: 2.3.43 (1269)	AppMind - Radio FM, Radio Online, Music and News	500,000	5	4
Super Volume Up - Speaker Booster, Sound Equalizer Package Name: com.cloyster.volumebooster.volumeup Version: 1.0.8 (9)	Cloyster team	100,000	8	4
Simple Radio -Free Live AM FM Radio & Music App Package Name: com.streema.simpleradio Version: 2.8.18 (241)	Streema, Inc.	10,000,000	4	3

(Table Continues)

Table 197 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
ABC listen Package Name: com.thisisaim.abcradio Version: 5.5.455.853 (853)	Australian Broadcasting Corporation	1,000,000	3	3
Radio Croatia: Online and Free FM Radio Package Name: com.radiolight.croatie Version: 1.9.19 (65)	Radioworld FM	10,000	4	3
Google Play Music Package Name: com.google.android.music Version: 8.24.8558-1.R (85581)	Google LLC	5,000,000,000	3	2
SoundCloud - Music & Audio Package Name: com.soundcloud.android Version: 2020.05.04-release (19090)	SoundCloud	100,000,000	2	2
Assistive Volume Button Package Name: com.nitin.volumnbutton Version: 2.45 (45)	Nitinscreation	100,000	2	2
Shazam - Discover songs & lyrics in seconds Package Name: com.shazam.android Version: 10.28.0-200430 (1002800)	Apple, Inc.	100,000,000	1	1
YouTube Music - Stream Songs & Music Videos Package Name: com.google.android.apps.youtube.music Version: 3.65.58 (36558240)	Google LLC	100,000,000	2	1
Free Music - Unlimited offline Music download free Package Name: com.yy.musicfm.global Version: 2.0.9 (302004100)	Free music player creator	5,000,000	1	1
Free Music : offline mp3 No WiFi Music Download Free Package Name: com.freemusic.offline.us Version: 1.0.9 (202003280)	Music & Game Inc.	1,000,000	1	1
YY Music -Free Music, Music player for Youtube Package Name: com.gugu.music Version: 2.1.0 (202001250)	YY Free Music	1,000,000	1	1
Sri Lanka Radio - All Radio Stations Online Package Name: com.srilanka.fmradio.lite Version: 5.1 (51)	Radio Pro Free Apps - Bizzlead	100,000	1	1
Spotify: Listen to new music, podcasts, and songs Package Name: com.spotify.music Version: 8.5.55.1105 (58727994)	Spotify Ltd.	500,000,000	0	0
Apple Music Package Name: com.apple.android.music Version: 3.2.2 (936)	Apple Inc.	50,000,000	0	0
Smart AudioBook Player Package Name: ak.alizandro.smartaudiobookplayer	Alex Kravchenko	1,000,000	0	0

(Table Continues)

Table 197 (Continued)

App	Developer	Installs	Recipients	
			Hostnames	Companies
Version: 6.6.3 (23663) Radio FM España - La mejor radio online gratis Package Name: com.cmobile.radiofm	Camadu	100,000	0	0
Version: 4.0.1 (91) All Gayatri Mantra Package Name: com.appz.religious.gayatricollection	Shivaay Technologies	50,000	0	0
Version: 1.0.1 (2) Macau Radio , Radio Macau , Macau Tuner Package Name: tw.com.off.macaudio	OFF Tech	10,000	0	0
Version: 2.7.0 (70)				

D.10.1.4 Popular Apps Transmitting Each Data Type

For each of these data types, Table 198 lists the top 5 most popular Music & Audio apps that we observed transmitting them during testing.¹⁶¹

Table 198: The top 5 Music & Audio apps that we detected transmitting each data type during the testing period.

Data Type	Top 5 Apps	Developer	# of Installs
AAID	Shazam - Discover songs & lyrics in seconds (com.shazam.android), v10.28.0-200430 (1002800)	Apple, Inc.	100,000,000
	YouTube Music - Stream Songs & Music Videos (com.google.android.apps.youtube.music), (36558240)	Google LLC v3.65.58	100,000,000
	SoundCloud - Music & Audio (com.soundcloud.android), v2020.05.04-release (19090)	SoundCloud	100,000,000
	TuneIn Radio: Live Sports, News, Music & Podcasts (tunein.player), v24.2 (261561)	TuneIn Inc	100,000,000
	iHeartRadio: Radio, Podcasts & Music On Demand (com.clearchannel.iheartradio.controller), v9.19.0 (709190003)	iHeartMedia, Inc.	50,000,000
Android ID	SoundCloud - Music & Audio (com.soundcloud.android), v2020.05.04-release (19090)	SoundCloud	100,000,000
	TuneIn Radio: Live Sports, News, Music & Podcasts (tunein.player), v24.2 (261561)	TuneIn Inc	100,000,000
	iHeartRadio: Radio, Podcasts & Music On Demand (com.clearchannel.iheartradio.controller), v9.19.0 (709190003)	iHeartMedia, Inc.	50,000,000
	Musixmatch - Lyrics for your music (com.musixmatch.android.lyrify), v7.5.9 (2020050401)	Musixmatch	50,000,000
	Audiomack: Download New Music Offline Free (com.audiomack), v5.4.5 (7056)	Audiomack	10,000,000
Email	Google Play Music (com.google.android.music), v8.24.8558-1.R (85581)	Google LLC	5,000,000,000
	iHeartRadio: Radio, Podcasts & Music On Demand (com.clearchannel.iheartradio.controller), v9.19.0 (709190003)	iHeartMedia, Inc.	50,000,000
Name	iHeartRadio: Radio, Podcasts & Music On Demand (com.clearchannel.iheartradio.controller), v9.19.0 (709190003)	iHeartMedia, Inc.	50,000,000

GPS Location

(Table Continues)

¹⁶¹Popularity is determined by the number of reported installs in the Google Play Store.

Table 198 (Continued)

Data Type	Top 5 Apps	Developer	# of Installs
	Radio Mexico: Online Radio, Internet Radio (com.appmind.radios.mx), v2.3.43 (1269)	AppMind - Radio FM, Radio Online, Music and News	500,000
	Coarse Location		
	Radio Mexico: Online Radio, Internet Radio (com.appmind.radios.mx), v2.3.43 (1269)	AppMind - Radio FM, Radio Online, Music and News	500,000
	GSF ID		
	Google Play Music (com.google.android.music), v8.24.8558-1.R (85581)	Google LLC	5,000,000,000

Table 199 lists the 5 most popular Music & Audio apps that transmitted the most data types during the testing period, whereas Table 200 lists the 5 most popular Music & Audio apps that transmitted the fewest data types during the testing period.

Top 5 Apps	Developer	# of Installs	Data Types
iHeartRadio: Radio, Podcasts & Music On Demand (com.clearchannel.iheartradio.controller), v9.19.0 (709190003)	iHeartMedia, Inc.	50,000,000	4
Radio Mexico: Online Radio, Internet Radio (com.appmind.radios.mx), v2.3.43 (1269)	AppMind - Radio FM, Radio Online, Music and News	500,000	4
Google Play Music (com.google.android.music), v8.24.8558-1.R (85581)	Google LLC	5,000,000,000	2
SoundCloud - Music & Audio (com.soundcloud.android), v2020.05.04-release (19090)	SoundCloud	100,000,000	2
TuneIn Radio: Live Sports, News, Music & Podcasts (tunein.player), v24.2 (261561)	TuneIn Inc	100,000,000	2

Table 199: The top 5 Music & Audio apps that transmitted the most data types during testing.

Top 5 Apps	Developer	# of Installs	Data Types
Spotify: Listen to new music, podcasts, and songs (com.spotify.music), v8.5.55.1105 (58727994)	Spotify Ltd.	500,000,000	0
Apple Music (com.apple.android.music), v3.2.2 (936)	Apple Inc.	50,000,000	0
Smart AudioBook Player (ak.alizandro.smartaudiobookplayer), v6.6.3 (23663)	Alex Kravchenko	1,000,000	0
Radio FM España - La mejor radio online gratis (com.cmobile.radiofm), v4.0.1 (91)	Camadu	100,000	0
All Gayatri Mantra (com.appz.religious.gayatricollection), v1.0.1 (2)	Shivaay Technologies	50,000	0

Table 200: The top 5 Music & Audio apps that transmitted the fewest data types during testing.

D.10.2 App Permissions

Apps in the Music & Audio category requested the dangerous permissions listed in Table 201.¹⁶²

Data Type	# of Apps	(% of Apps)
WRITE_EXTERNAL_STORAGE	26	(92.9%)
READ_EXTERNAL_STORAGE	21	(75.0%)
READ_PHONE_STATE	12	(42.9%)
GET_ACCOUNTS	10	(35.7%)
ACCESS_COARSE_LOCATION	9	(32.1%)
ACCESS_FINE_LOCATION	7	(25.0%)
RECORD_AUDIO	6	(21.4%)
CAMERA	2	(7.1%)
READ_CONTACTS	1	(3.6%)
ACCESS_BACKGROUND_LOCATION	1	(3.6%)

Table 201: Dangerous permissions requested by apps in the Music & Audio category.

¹⁶²For an explanation of dangerous permissions, see Section 4.3.

D.10.2.1 Popular Apps Requesting Dangerous Permissions For each of these permissions, Table 202 lists the top 5 most popular apps that we observed requesting dangerous permissions during testing.¹⁶³

Table 202: The 5 most popular Music & Audio apps that requested each dangerous permission.

Permission	Top 5 Apps	Developer	# of Installs
WRITE_EXTERNAL_STORAGE	Google Play Music (com.google.android.music), v8.24.8558-1.R (85581)	Google LLC	5,000,000,000
	Spotify: Listen to new music, podcasts, and songs (com.spotify.music), v8.5.55.1105 (58727994)	Spotify Ltd.	500,000,000
	YouTube Music - Stream Songs & Music Videos (com.google.android.apps.youtube.music), v3.65.58 (36558240)	Google LLC	100,000,000
	SoundCloud - Music & Audio (com.soundcloud.android), v2020.05.04-release (19090)	SoundCloud	100,000,000
	TuneIn Radio: Live Sports, News, Music & Podcasts (tunein.player), v24.2 (261561)	TuneIn Inc	100,000,000
READ_EXTERNAL_STORAGE	Spotify: Listen to new music, podcasts, and songs (com.spotify.music), v8.5.55.1105 (58727994)	Spotify Ltd.	500,000,000
	YouTube Music - Stream Songs & Music Videos (com.google.android.apps.youtube.music), v3.65.58 (36558240)	Google LLC	100,000,000
	SoundCloud - Music & Audio (com.soundcloud.android), v2020.05.04-release (19090)	SoundCloud	100,000,000
	TuneIn Radio: Live Sports, News, Music & Podcasts (tunein.player), v24.2 (261561)	TuneIn Inc	100,000,000
	iHeartRadio: Radio, Podcasts & Music On Demand (com.clearchannel.iheartradio.controller), v9.19.0 (709190003)	iHeartMedia, Inc.	50,000,000
READ_PHONE_STATE	Spotify: Listen to new music, podcasts, and songs (com.spotify.music), v8.5.55.1105 (58727994)	Spotify Ltd.	500,000,000
	iHeartRadio: Radio, Podcasts & Music On Demand (com.clearchannel.iheartradio.controller), v9.19.0 (709190003)	iHeartMedia, Inc.	50,000,000
	Musixmatch - Lyrics for your music (com.musixmatch.android.lyrify), v7.5.9 (2020050401)	Musixmatch	50,000,000
	Audiomack: Download New Music Offline Free (com.audiomack), v5.4.5 (7056)	Audiomack	10,000,000
	Simple Radio -Free Live AM FM Radio & Music App (Table Continues)	Streema, Inc.	10,000,000

¹⁶³Popularity is determined by the number of reported installs in the Google Play Store.

Table 202 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	(com.streema.simpleradio), v2.8.18 (241)		
GET_ACCOUNTS			
	Google Play Music (com.google.android.music), v8.24.8558-1.R (85581)	Google LLC	5,000,000,000
	Spotify: Listen to new music, podcasts, and songs (com.spotify.music), v8.5.55.1105 (58727994)	Spotify Ltd.	500,000,000
	Shazam - Discover songs & lyrics in seconds (com.shazam.android), v10.28.0-200430 (1002800)	Apple, Inc.	100,000,000
	YouTube Music - Stream Songs & Music Videos (com.google.android.apps.youtube.music), v3.65.58 (36558240)	Google LLC	100,000,000
	SoundCloud - Music & Audio (com.soundcloud.android), v2020.05.04-release (19090)	SoundCloud	100,000,000
ACCESS_COARSE_LOCATION			
	Shazam - Discover songs & lyrics in seconds (com.shazam.android), v10.28.0-200430 (1002800)	Apple, Inc.	100,000,000
	TuneIn Radio: Live Sports, News, Music & Podcasts (tunein.player), v24.2 (261561)	TuneIn Inc	100,000,000
	Audiomack: Download New Music Offline Free (com.audiomack), v5.4.5 (7056)	Audiomack	10,000,000
	Stitcher - Podcast Player (com.stitcher.app), v4.8.0 (1463)	Stitcher, Inc	5,000,000
	Free Music - Unlimited offline Music download free (com.yy.musicfm.global), v2.0.9 (302004100)	Free music player creator	5,000,000
ACCESS_FINE_LOCATION			
	Shazam - Discover songs & lyrics in seconds (com.shazam.android), v10.28.0-200430 (1002800)	Apple, Inc.	100,000,000
	TuneIn Radio: Live Sports, News, Music & Podcasts (tunein.player), v24.2 (261561)	TuneIn Inc	100,000,000
	iHeartRadio: Radio, Podcasts & Music On Demand (com.clearchannel.iheartradio.controller), v9.19.0 (709190003)	iHeartMedia, Inc.	50,000,000
	ABC listen (com.thisisaim.abcradio), v5.5.455.853 (853)	Australian Broadcasting Corporation	1,000,000
	Radio Mexico: Online Radio, Internet Radio (com.appmind.radios.mx), v2.3.43 (1269)	AppMind - Radio FM, Radio Online, Music and News	500,000
RECORD_AUDIO			
	Shazam - Discover songs & lyrics in seconds (com.shazam.android), v10.28.0-200430 (1002800)	Apple, Inc.	100,000,000
	SoundCloud - Music & Audio (com.soundcloud.android), v2020.05.04-release (19090)	SoundCloud	100,000,000

(Table Continues)

Table 202 (Continued)

Permission	Top 5 Apps	Developer	# of Installs
	Musixmatch - Lyrics for your music (com.musixmatch.android.lyrify), v7.5.9 (2020050401)	Musixmatch	50,000,000
	Extra-High Volume Booster & Loud Speaker Booster (com.extravolumebooster.soundamplifier.equalizer), v2.1.2 (6)	Cetin FunLab	500,000
	Super Volume Up - Speaker Booster, Sound Equalizer (com.cloyster.volumebooster.volumeup), v1.0.8 (9)	Cloyster team	100,000
CAMERA			
	Audiomack: Download New Music Offline Free (com.audiomack), v5.4.5 (7056)	Audiomack	10,000,000
	Extra-High Volume Booster & Loud Speaker Booster (com.extravolumebooster.soundamplifier.equalizer), v2.1.2 (6)	Cetin FunLab	500,000
READ_CONTACTS			
	Apple Music (com.apple.android.music), v3.2.2 (936)	Apple Inc.	50,000,000
ACCESS_BACKGROUND_LOCATION			
	Radio Mexico: Online Radio, Internet Radio (com.appmind.radios.mx), v2.3.43 (1269)	AppMind - Radio FM, Radio Online, Music and News	500,000

Table 203 lists the 5 most popular Music & Audio apps that requested the most permissions, whereas Table 204 lists the 5 most popular Music & Audio apps that requested the fewest permissions.

Top 5 Apps	Developer	# of Installs	Permissions
Google Play Music (com.google.android.music), v8.24.8558-1.R (85581)	Google LLC	5,000,000,000	21
Musixmatch - Lyrics for your music (com.musixmatch.android.lyrify), v7.5.9 (2020050401)	Musixmatch	50,000,000	21
Radio Mexico: Online Radio, Internet Radio (com.appmind.radios.mx), v2.3.43 (1269)	AppMind - Radio FM, Radio Online, Music and News	500,000	19
Spotify: Listen to new music, podcasts, and songs (com.spotify.music), v8.5.55.1105 (58727994)	Spotify Ltd.	500,000,000	18
YouTube Music - Stream Songs & Music Videos (com.google.android.apps.youtube.music), (36558240)	v3.65.58 Google LLC	100,000,000	16

Table 203: The 5 most popular Music & Audio apps that requested the most permissions.

Top 5 Apps	Developer	# of Installs	Permissions
Smart AudioBook Player (ak.alizandro.smartaudiobookplayer), v6.6.3 (23663)	Alex Kravchenko	1,000,000	6
All Gayatri Mantra (com.appz.religious.gayatricollection), v1.0.1 (2)	Shivaay Technologies	50,000	6
Sri Lanka Radio - All Radio Stations Online (com.srilanka.fmradio.life), v5.1 (51)	Radio Pro Free Apps - Bizzlead	100,000	7
Radio Croatia: Online and Free FM Radio (com.radiolight.croatie), v1.9.19 (65)	Radioworld FM	10,000	7
Simple Radio -Free Live AM FM Radio & Music App (com.streema.simpleradio), v2.8.18 (241)	Streema, Inc.	10,000,000	8

Table 204: The 5 most popular Music & Audio apps that requested the least number of permissions.

D.10.2.2 Permission Usage While the previous subsection depicted the dangerous permissions *requested* by the apps that were tested, Table 205 lists the Music & Audio apps based on the dangerous permissions that were observed being *used* during the testing period.

Table 205: Music & Audio apps based on total number of permissions requested, the number of those that are considered “dangerous,” and the percentage of those dangerous permissions that were used during testing.

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
Musixmatch - Lyrics for your music (com.musixmatch.android.lyrify), v7.5.9 (2020050401)	Musixmatch	21	4	0.0
Google Play Music (com.google.android.music), v8.24.8558-1.R (85581)	Google LLC	21	2	0.0
Radio Mexico: Online Radio, Internet Radio (com.appmind.radios.mx), v2.3.43 (1269)	AppMind - Radio FM, Radio Online, Music and News	19	6	33.3
Spotify: Listen to new music, podcasts, and songs (com.spotify.music), v8.5.55.1105 (58727994)	Spotify Ltd.	18	4	0.0
YouTube Music - Stream Songs & Music Videos (com.google.android.apps.youtube.music), v3.65.58 (36558240)	Google LLC	16	3	0.0
iHeartRadio: Radio, Podcasts & Music On Demand (com.clearchannel.iheartradio.controller), v9.19.0 (709190003)	iHeartMedia, Inc.	15	4	0.0
SoundCloud - Music & Audio (com.soundcloud.android), v2020.05.04-release (19090)	SoundCloud	15	4	0.0
Free Music - Unlimited offline Music download free (com.yy.musicfm.global), v2.0.9 (302004100)	Free music player creator	15	4	0.0
BG Player (com.music.bgplayer), v4.0.12 (26)	Yossef Faroh Zada	15	4	0.0
Free Music : offline mp3 No WiFi Music Download Free (com.freemusic.offline.us), v1.0.9 (202003280)	Music & Game Inc.	15	4	0.0
Stitcher - Podcast Player (com.stitcher.app), v4.8.0 (1463)	Stitcher, Inc	15	4	25.0
Apple Music (com.apple.android.music), v3.2.2 (936)	Apple Inc.	14	3	0.0
YY Music -Free Music, Music player for Youtube (com.gugu.music), v2.1.0 (202001250)	YY Free Music	14	3	0.0
Audiomack: Download New Music Offline Free (com.audiomack), v5.4.5 (7056)	Audiomack	13	5	0.0
TuneIn Radio: Live Sports, News, Music & Podcasts (tunein.player), v24.2 (261561)	TuneIn Inc	13	4	0.0

(Table Continues)

Table 205 (Continued)

Top 5 Apps	Developer	# Requested	# Dangerous	% Dangerous Used
Radio FM España - La mejor radio online gratis (com.cmobile.radiofm), v4.0.1 (91)	Camadu	13	4	0.0
Extra-High Volume Booster & Loud Speaker Booster (com.extravolumebooster.soundamplifier.equalizer), v2.1.2 (6)	Cetin FunLab	13	4	25.0
Rocker Music Player 2020 - PowerAudio & MP3 Player (com.ginger.musicplayer), v1.0.9 (9)	Ginger Team	12	3	0.0
ABC listen (com.thisisaim.abcradio), v5.5.455.853 (853)	Australian Broadcasting Corporation	11	5	0.0
Shazam - Discover songs & lyrics in seconds (com.shazam.android), v10.28.0-200430 (1002800)	Apple, Inc.	11	4	0.0
Super Volume Up - Speaker Booster, Sound Equalizer (com.cloyster.volumebooster.volumeup), v1.0.8 (9)	Cloyster team	10	3	0.0
Assistive Volume Button (com.nitinn.volumnbutton), v2.45 (45)	Nitinscreation	9	1	0.0
Macau Radio , Radio Macau , Macau Tuner (tw.com.off.macauradio), v2.7.0 (70)	OFF Tech	9	2	0.0
Simple Radio -Free Live AM FM Radio & Music App (com.streema.simpleradio), v2.8.18 (241)	Streema, Inc.	8	4	0.0
Sri Lanka Radio - All Radio Stations Online (com.srilanka.fmradio.life), v5.1 (51)	Radio Pro Free Apps - Bizzlead	7	3	0.0
Radio Croatia: Online and Free FM Radio (com.radiolight.croatie), v1.9.19 (65)	Radioworld FM	7	2	0.0
Smart AudioBook Player (ak.alizandro.smartaudiobookplayer), v6.6.3 (23663)	Alex Kravchenko	6	1	0.0
All Gayatri Mantra (com.appz.religious.gayatricollection), v1.0.1 (2)	Shivaay Technologies	6	1	0.0

D.10.3 Third-Party SDKs

We were able to identify 115 SDKs embedded within the 28 Music & Audio apps. We list the 40 most common SDKs in Table 206,¹⁶⁴ along with the number of Music & Audio apps in which they were detected.

Table 206: The 40 most common SDKs identified within apps in the Music & Audio category.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	28	(100.0%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	26	(92.9%)
Google Ads	Google	Advertisement	21	(75.0%)
Crashlytics	Google	Mobile Analytics	19	(67.9%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	18	(64.3%)
Google Gson	Google	Development Aid	18	(64.3%)
Google DoubleClick	Google	Advertisement	18	(64.3%)
Facebook Login	Facebook	Digital Identity Advertisement Mobile Analytics	15	(53.6%)
Glide	Bump Technologies	Development Aid	14	(50.0%)
Facebook Share	Facebook	Social Network Advertisement Mobile Analytics	14	(50.0%)
Facebook Analytics	Facebook	Mobile Analytics	13	(46.4%)
ZXing ('Zebra Crossing')	ZXing Project	Development Aid	13	(46.4%)
Google Play	Google Play	App Market	13	(46.4%)

(Table Continues)

¹⁶⁴For an explanation of SDKs, see Section 4.1.2.

Table 206 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Core Libraries for Java 6+	Google	Development Aid	12	(42.9%)
Google Protocol Buffers	Google	Development Aid	12	(42.9%)
picasso	Square Inc.	Development Aid	11	(39.3%)
Moat	Oracle	Mobile Analytics	9	(32.1%)
Apache Common	The Apache Software Founda- tion	Development Aid	9	(32.1%)
Facebook Ads	Facebook	Advertisement	9	(32.1%)
Facebook Places	Facebook	Map/LBS Advertisement	8	(28.6%)
Fasterxml	FasterXML	Utility	8	(28.6%)
MoPub	Twitter	Advertisement	7	(25.0%)
Flurry	Verizon	Mobile Analytics	6	(21.4%)
Google Analytics	Google	Mobile Analytics	6	(21.4%)
Google Tag Manager	Google	Mobile Analytics	6	(21.4%)
OkHttp	OkHttp	Development Aid	5	(17.9%)
comscore	Comscore	Mobile Analytics	5	(17.9%)
Github	Github	Development Aid	5	(17.9%)
Google Core Libraries (3rd Party)	Google	Development Aid	5	(17.9%)
JavaX Annotation API	JavaX Annotation API	Utility	5	(17.9%)
Jsoup	Jsoup	Development Aid	5	(17.9%)
Branch	Branch Metrics	Mobile Analytics Advertisement	4	(14.3%)
Amazon Advertisement	Amazon	Advertisement	4	(14.3%)
Applovin	AppLovin	Advertisement	4	(14.3%)
Inmobi	InMobi	Advertisement	4	(14.3%)
Unity3D	Unity Technologies	Game Engine Mobile Analytics Advertisement	4	(14.3%)

(Table Continues)

Table 206 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Unity3d Ads	Unity Technologies	Advertisement	4	(14.3%)
Volley HTTP library	Google	Development Aid Networking	4	(14.3%)
Google API Client Libraries	Google	Development Framework	4	(14.3%)
XML Pull	XML Pull	Development Aid	3	(10.7%)

Several of these SDKs included developer tools, which we characterize as SDKs that provide tools and functionality to app developers which are unlikely to be used for the transmission of user information. As a result, we separately present Table 207, which depicts the 40 most common SDKs with developer tools removed, along with the number of Music & Audio apps in which they were detected.

Table 207: The 40 most common SDKs identified within apps in the Music & Audio category, with developer tools removed.

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Google Mobile Services	Google	Development Aid Advertisement Mobile Analytics Authentication	28	(100.0%)
Firebase	Google	Development Aid Mobile Analytics Advertisement LBS Utility	26	(92.9%)
Google Ads	Google	Advertisement	21	(75.0%)
Crashlytics	Google	Mobile Analytics	19	(67.9%)
Facebook	Facebook	Social Network Advertisement Mobile Analytics	18	(64.3%)
Google DoubleClick	Google	Advertisement	18	(64.3%)

(Table Continues)

Table 207 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
Facebook Login	Facebook	Digital Identity Advertisement Mobile Analytics	15	(53.6%)
Facebook Share	Facebook	Social Network Advertisement Mobile Analytics	14	(50.0%)
Facebook Analytics	Facebook	Mobile Analytics	13	(46.4%)
Google Play	Google Play	App Market	13	(46.4%)
Moat	Oracle	Mobile Analytics	9	(32.1%)
Facebook Ads	Facebook	Advertisement	9	(32.1%)
Facebook Places	Facebook	Map/LBS Advertisement	8	(28.6%)
MoPub	Twitter	Advertisement	7	(25.0%)
Flurry	Verizon	Mobile Analytics	6	(21.4%)
Google Analytics	Google	Mobile Analytics	6	(21.4%)
Google Tag Manager	Google	Mobile Analytics	6	(21.4%)
comscore	Comscore	Mobile Analytics	5	(17.9%)
Branch	Branch Metrics	Mobile Analytics Advertisement	4	(14.3%)
Amazon Advertisement	Amazon	Advertisement	4	(14.3%)
Applovin	AppLovin	Advertisement	4	(14.3%)
Inmobi	InMobi	Advertisement	4	(14.3%)
Unity3D	Unity Technologies	Game Engine Mobile Analytics Advertisement	4	(14.3%)
Unity3d Ads	Unity Technologies	Advertisement	4	(14.3%)
Volley HTTP library	Google	Development Aid Networking	4	(14.3%)
AdColony	AdColony	Advertisement	3	(10.7%)
IronSource	IronSource	Advertisement	3	(10.7%)

(Table Continues)

Table 207 (Continued)

SDK Name	Parent Company	Category	# of Apps	(% of Apps)
		Mobile Analytics		
Ogury Presage	Ogury	Advertisement	3	(10.7%)
adjust	Adjust	Mobile Analytics Advertisement	3	(10.7%)
Integral Ad Science	Integral Ad Science Inc.	Mobile Analytics Advertisement AdFraud	3	(10.7%)
Nielsen	Nielsen	Mobile Analytics	2	(7.1%)
AdsWizz	AdsWizz	http://www.adswizz.com/	2	(7.1%)
Krux	Salesforce	Mobile Analytics	2	(7.1%)
AppsFlyer	AppsFlyer	Mobile Analytics AdFraud	2	(7.1%)
OneSignal	OneSignal	Mobile Analytics	2	(7.1%)
Tapjoy	Tapjoy	Advertisement	2	(7.1%)
Vungle	Vungle	Advertisement	2	(7.1%)
Bugsnag	Bugsnag	Mobile Analytics	2	(7.1%)
Smaato	Smaato	Advertisement LBS	2	(7.1%)
Snowplow	Snowplow Analytics	Mobile Analytics	1	(3.6%)