

## Supplementary Online Content

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**eTable 1.** Number of Users, Data Transmissions, Unique Data Type Transmissions, and Third Party Domains, 451 Android Apps Played by 124 Preschool-Aged Children

**eTable 2.** Transmission and Domain Counts by DFF Status and App Popularity

**eTable 3.** Top 50 Most Common Third-Party Domains to Which Identifiers Were Transmitted by Apps Analyzed in the Current Study

This supplementary material has been provided by the authors to give readers additional information about their work.

**eTable 1. Number of Users, Data Transmissions, Unique Data Type Transmissions, and Third Party Domains, 451 Android Apps Played by 124 Preschool-Aged Children**

App Package Name	App Name	Number of persistent identifier transmissions	Number of unique data types transmitted	Number of unique third party domains
com.game5mobile.lineandwater	Happy Glass	57	2	33
com.kwalee.wantedgp	Police Pursuit	57	2	29
com.outfit7.talkingtom	Talking Tom Cat	51	2	29
com.gamecircus.PrizeClaw	Prize Claw	49	4	14
com.supertapx.bigbigballer	Big Big Baller	48	2	30
com.ketchapp.rotator	Rotator	48	2	29
com.bigframes.color_road	Color Road	46	3	32
com.crowdstar.covetHome	Design Home	46	2	16
io.voodoo.holeio	Hole.io	44	3	25
com.h8games.helixjump	Helix Jump	42	3	30
com.sega.sonicdash	Sonic Dash	40	2	21
com.leodesol.games.classic.maze.labyrinth	Mazes & More	40	1	23
com.ketchapp.pineapplepen	Pineapple Pen	39	2	30
com.outfit7.talkingtom2free	Talking Tom Cat 2	37	3	26
com.crazylabs.amaze.game	AMAZE!	36	2	21
com.ketchapp.mrgun	Mr Gun	35	2	20
com.playgendary.kickthebuddy	Kick the Buddy	34	2	16
furniture.mods.ran	furniture mod	34	4	25
com.sega.sprint	Sonic Forces	33	2	20
com.parking.game	Drive and Park	32	2	23
com.outfit7.mytalkinghank	My Talking Hank	32	3	23
tv.peel.app	Peel Universal Smart TV Remote Control	32	7	10
com.buildingcraftingames.top.gun.minecraft.free.plane.build.craft.exploration.game.lite.pocket.mcp.e.roblox.sky.world.war.jet	Plane Craft: Square Air	32	2	23
com.outfit7.talkingtomgoldrun	Talking Tom Gold Run	31	1	24
com.outfit7.talkinggingerfree	Talking Ginger	31	2	17

com.playcoolzombiesportgames.space.mine.craft.exploration.lite.build.minecraft.voxel.creative.cosmos.galaxy.sandbox.cube.pixel	Space Craft	30	2	23
com.playgendary.tom	Tomb of the Mask	29	2	20
com.supertapx.lovedots	Love Balls	29	2	20
com.outfit7.jigty.jelly	Jigty Jelly	29	3	17
com.outfit7.talkingtomjetski2	Talking Tom Jetski 2	29	2	21
com.aim.racing	Extreme Car Driving Simulatr	28	2	13
com.survivalcrafting.rc.minecraft.t.helicopter.games.flight.flying.simulator.fly.aircraft.heli.craft.plane.gunship.chopper.free	Helicopter Craft: Flying & Crafting Game 2018	27	2	20
com.outfit7.mytalkingangelafree	My Talking Angela	27	3	22
com.terrorist.shooter.lu	Terrorist Shooter	27	2	11
com.ea.BejeweledBlitz_na	Bejeweled Blitz	26	2	5
com.miniclip.bowmasters	Bowmasters	26	2	21
com.sega.sonic1px	Sonic the Hedgehog Classic	25	1	14
com.nordcurrent.canteenhd	Cooking Fever	25	2	13
com.ludia.dragons	Dragons: Rise of Berk	24	2	14
com.junegaming.ninjafunrace	Ninja Race - Fun Run Multiplayer	24	2	14
com.playgendary.tanks	Tank Stars	24	2	18
com.ketchapp.thefloorislava	The Floor Is lava	24	2	17
com.riseup.game	Rise Up	23	2	17
com.lastpass.lpandroid	Lastpass Password Manager	22	2	4
com.pmg.speed	SpeedBall	22	3	14
com.ketchapp.rider	Rider	21	2	17
com.dodreams.driveahead	Drive Ahead!	21	2	15
com.sega.sonicjumpfever	Sonic Jump Fever	21	2	15
com.outfit7.mytalkingtomfree	My Talking Tom	19	2	17
com.fungames.blockcraft	Block Craft 3D: Building Simulator Games For Free	19	2	16
com.crazylabs.sausage.run	Run Sausage Run!	19	2	10
com.alien.shooter.galaxy.attack	Galaxy Attack: Alien Shooter	19	2	12

com.ea.game.pvzfree_row	Plants vs. Zombies FREE	19	2	11
com.strawdogstudios.simonscatpoptime	Simon's Cat - Pop Time	19	2	15
com.scopely.whiplash	WWE Champions 2019	19	3	10
com.jamcity.snoopypop	Snoopy Pop - Free Match, Blast & Pop Buble Game	18	4	10
com.geishatokyo.snowballio	Snowball.io	18	3	11
com.outfit7.gingersbirthdayfree	Talking Ginger 2	18	2	13
com.sega.sonic2.runner	Sonic The Hedgehog 2 Classic	17	2	12
com.fingersoft.hcr2	Hill Climb Racing 2	17	2	15
com.hutchgames.hotwheels	Hot Wheels: Race Off	17	2	16
com.crazylabs.lady.bug	Miraculous Ladybug& Cat Noir - The Official Game	17	2	17
es.socialpoint.MonsterLegends	Monster Legends	17	3	5
com.backflipstudios.android.ninj umpdeluxe	NinJump DLX: Endless Ninja Fun	17	5	7
tv.peel.samsung.app	Peel Smart Remote TV Guide	17	6	8
com.cmplay.bricksnballs	Bricks n Balls	16	5	13
com.YovoGames.carRepair3	Repair machines - monster trucks	16	2	6
com.kintor.grannymods	Scary Granny Mods - Horror House Escape	16	4	12
com.launchshipstudios.dots.connect	Spots Connect	16	4	11
com.cyberlink.youcammakeup	YouCam Makeup- Magic Selfie Makeovers	16	2	14
com.dvloper.granny	Granny	15	2	12
com.cocoplay.puppyparty	Puppy Life - Secret Pet Party	15	2	10
com.zhiliaoapp.musically	TikTok	15	4	10
com.sinyee.babybus.magichouse	Baby Panda's Color Mixing Studio	15	1	9
com.hippo.SantasWorkshop	Santa's workshop: Christmas Eve	15	2	12
com.timuzgames.shooting.games	Shooting Master 3D	15	2	13

com.camera.beautycam	Snapfun - Face Filter, Selfie Editor, Sweet Camera	15	3	8
com.tabtale.babytwins	Baby Twins - Newborn Care	14	1	10
com.gpp.beefactory	Bee Factory	14	1	12
com.agminstruments.drumpadmachine	Drum Pad Machine - Make Beats	14	2	9
com.Chateau.SanicNoAds	Free Version for Sanic Ball	14	2	9
eu.bandainamcoent.mytamagotchiforever	My Tamagotchi Forever	14	2	12
com.mightykingdom.shopkinscutiecars	Shopkins: Cutie Cars	14	2	11
com.sx.wonsterwords	Wonster ABC Phonics Spelling	14	2	5
com.daily.zodiac.signs.horoscope.palmistry	Zodiac Signs Master - Palmistry & Horoscope 2019	14	2	5
com.rovio.angrybirds	Angry Birds Classic	13	1	10
com.cocoplay.erpetvet	Doctor Fluff Pet Vet	13	2	9
es.socialpoint.DragonCity	Dragon City	13	2	5
com.hitcents.drawastickmanepic2free	Draw a Stickman: EPIC 2 Free	13	2	12
com.playrix.homescapes	Homescapes	13	2	12
kjv.bible.kingjamesbible	King James Bible (KJV) - Free Bible Verses + Audio	13	2	6
com.azurgames.BattleGroundRoyale	PIXEL'S UNKNOWN BATTLE GROUND	13	2	8
net.peakgames.toonblast	Toon Blast	13	2	5
com.bitmango.go.wheresmyavocadoadodrawlines	Where's My Avocado? Draw lines	13	2	8
com.sinyee.babybus.digging	Baby Panda's Treasure Island	12	2	11
com.rr.carrace	Mega Ramp Car Racing Impossible Stunts	12	2	11
com.bfs.ninjump	NinJump	12	5	6
com.hulu.plus	Hulu: Stream TV, Movies & more	11	2	9
com.sinyee.babybus.digestion	Baby Panda's Body Adventure	11	1	8

com.sinyee.babybus.toilet	Baby Panda's Potty Training - Toilet Time	11	1	8
com.mmarcel.cnb2	Crafting and Building	11	1	9
com.photoappworld.cut.paste.photo	Cut and Paste Photos	11	1	7
com.playcreek.DeathWorm_Free	Death Worm™ Free	11	2	7
com.dobsoftstudios.gunfustickman2	Gun Fu: Stickman 2	11	2	9
com.chateaustudios.sanicclickmaniaAndroid	Sanic Clicker Maniiia : Tap Adventure	11	2	8
com.sportsgame.stuntmotoracing.free	Stunt Moto Racing	11	2	11
net.mobigame.zombietsunami	Zombie Tsunami	11	3	8
com.tabtale.nailfiasco	Candy Nail Art - Sweet Fashion	10	2	4
air.com.sgn.cookiejam.gp	Cookie Jam - Match 3 Games & Free Puzzle Game	10	2	4
com.greenteagames.dogracing3d	Dog Run - Pet Dog Simulator	10	2	8
flipboard.app	Flipboard: News For Our Time	10	2	8
com.beansprites.rainbowicecream.popsiclesFREE	Ice Cream & Popsicles - Yummy Ice Cream Free	10	2	7
com.kauf.monstertruckracinghero3d	Monster Truck Racing Hero 3D by Kaufcom	10	2	6
eu.bandainamcoent.pacman256	PAC-MAN 256 - Endless Maze	10	2	7
com.gameone.superadventuresofjabber.free	Super Adventures of Jabber	9	1	9
com.sinyee.babybus.homesafe.global	Baby Panda Home Safety	9	1	8
com.amayasoft.cars.kids.toddlercars.garage.game	Car game for toddlers - kids cars racing games	9	2	6
super.smash.world.bros	Sboy World Adventure 2018	9	1	7
com.strawdogstudios.simonscatcrunchtime	Simon's Cat - Crunch Time	9	2	6
com.tutotoons.app.sweetbabygirlsummercamp.free	Sweet Baby Girl Summer Camp	9	2	3

com.contextlogic.wish	Wish - Shopping Made Fun	9	5	5
com.freeBabyGames.balloonPopKids	Balloon Pop Kids Learning Game Free for babies	8	2	6
com.budgetstudios.HelloKittyNailSalon	Hello Kitty Nail Salon	8	2	7
com.zeptolab.cats.google	CATS: Crash Arena Turbo Stars	8	2	5
de.pictofun.labyrinthone	Classic Labyrinth 3d Maze - free games	8	2	6
com.impp.motorbike.megaramp.jump	Impossible Mega Ramp Moto Bike Rider Superhero Car	8	2	6
com.brokenreality.planemerger.android	Merge Plane - Click & Idle Tycoon	8	2	6
com.mobileposse.client	metroZONE	8	7	2
com.pixel.gun3d	Pixel Gun 3D: Shooting games & Battle Royale	8	2	7
com.vcast.mediamanager	Verizon Cloud	8	3	2
com.YovoGames.dentist	Children's doctor: dentist	7	2	5
com.oki.alphabetnew	ABCD for kids - ABC Learning games for toddlers	7	2	4
com.avg.cleaner	AVG Cleaner - Speed, Battery, Memory & RAM Booster	7	1	3
jackhil.pixel.art.masks.color.number	Color By Number Pixel Art Moonlight Hero	7	2	6
com.gonoodle.gonoodle	GoNoodle - Kid Movement & Mindfulness Videos!	7	1	2
com.google.android.music	Google Play Music	7	4	3
brilliant.sari	Kids Brain Trainer (Preschool)	7	1	6
com.tutotoons.app.kikififipetbeautysalon.free	Kiki & Fifi Pet Beauty Salon - Haircut & Makeup	7	2	3
com.mcdonalds.app	McDonald's	7	5	4
com.stickwar.legend	Stickman War: Beyond Legendary	7	2	6
com.ioplayjoy.stickmansuperme	Stickman.io Superme	7	2	7
com.edujoy.toddler.games	Toddler & Baby Games	7	1	6

com.knights.bikesstunt.motomas ter	Bike Stunt race Master 3d Racing - New Free Games	6	2	5
com.blippar.ar.android	Blippar - The Augmented Reality browser	6	3	4
com.king.candycrushjellysaga	Candy Crush Jelly Saga	6	3	3
com.crazylabs.coin.rush	Coin Rush!	6	2	5
com.dodreams.driveaheadsports	Drive Ahead! Sports	6	2	6
com.myhomescreen.email	Email Home - Full Screen Email Widget and Launcher	6	2	5
com.aa.extreme.city.gt.car.stunts	Extreme City GT Car Stunts	6	2	5
com.wikia.singlewikia.sonic	FANDOM for: Sonic	6	2	4
com.funpop.android_hatch	Hatch Baby Animal- Hatch Egg Spa Salon	6	2	4
com.superplusgames.hosandroid	Hills of Steel	6	2	5
zok.android.numbers	Kids Numbers and Math FREE	6	2	2
com.bigbluebubble.msm2	My Singing Monsters: Dawn of Fire	6	2	4
com.babymariagames.puppypetd aycare	Puppy Pet Daycare	6	1	5
com.ffgames.racingincar2	Racing in Car 2	6	2	3
com.gameone.jabbersuperjump2. free	Super Jabber Jump 2	6	2	6
com.gi.talkinggummybear	Talking Gummy Bear Free	6	2	5
com.outfit7.talkingpierrefree	Talking Pierre the Parrot	6	3	4
com.xfinity.cloudtvr	Xfinity Stream	6	4	2
mobi.abcmouse.academy_goo	ABC Mouse.com	5	2	4
com.kiloo.subwaysurf	Subway Surfers	5	2	4
com.king.candycrushsodasaga	Candy Crush Soda Saga	5	3	2
com.pandora.android	Pandora Music	5	2	3
com.disney.datg.videoplatforms. android.watchdc	DisneyNOW - Episodes & Live TV	5	2	4
com.namcobandaigames.pacman tournaments	PAC-MAN	5	2	4
forqan.tech.babypuzzles_dinosa urs.ads	Dinosaurs Puzzles for Kids - FREE	5	1	4
com.apocafistteam.games	Hatchimals surprise eggs	5	2	4

com.getsomeheadspace.android	Headspace: Meditation & Sleep	5	1	4
com.greysprings.kindergarten8	Kindergarten Kids Learning: Fun Educational Games	5	2	3
com.lipalearning.lipazoo.game	Lipa Zoo	5	3	2
com.microsoft.emmx	Microsoft Edge	5	3	4
com.microsoft.office.outlook	Microsoft Outlook	5	2	2
com.tutotoons.app.pandalubabybearcare2.free	Panda Lu Baby Bear Care	5	2	2
com.pbs.video	PBS Video	5	2	3
com.ea.game.pvz2_na	Plants vs. Zombies 2 FREE	5	2	3
air.com.tutotoons.app.powergirlssupercity.free	Power Girls Super City - Superhero Salon & Pets	5	2	3
com.world3dgames.rushKartRacing	Rush Kart Racing 3D	5	2	4
com.dingogames.tastyplanet4	Tasty Planet Forever	5	2	2
com.amctv.thewalkingdead.deadyourself	The Walking Dead Dead Yourself	5	3	3
com.tinybeans	Tinybeans Family Album, Babby Book, Photo Journal	5	2	4
com.outfit7.tomslovelettersfree	Tom's Love Letters	5	3	4
com.amazon.avod.thirdpartyclient	Amazon Prime Video	4	2	3
com.king.candycrushsaga	Candy Crush Saga	4	3	2
com.tutotoons.app.cathairsalonbirthdayparty.free	Cat Hair Salon Birthday Party	4	2	2
com.pjmasksmoonlightheroes	PJ Masks: Moonlight Heroes	4	2	3
com.sagosago.ConstructionWinter.googleplay.free	Sago Mini Holiday Trucks and Diggers	4	2	2
com.threed.bowling	3D Bowling	4	3	4
mobi.abcmouse.mrt.google	ABCmouse Magic Rainbow Traceables	4	2	3
com.rovio.baba	Angry Birds 2	4	2	3
com.jiubang.alock	AppLock	4	2	4
com.hiddenvariable.bagit	Bag it!	4	2	2

com.mattel.barbiesparkleblastkids	Barbie Fashion Closet	4	2	3
com.disney.cars3_goo	Cars: Lightning League	4	1	4
com.scarydudes.green.grandpa.alien	Grandpa Alien Escape Game	4	2	3
com.spinmaster.enterprise.colleggtibles	Hatchimals COLLEGGtibles	4	2	3
com.mobirix.throwball	Hit & Knock down	4	2	3
air.mobi.ka.platform.gp.cont1.free	Kids Academy: Talented & Gifted	4	4	1
com.lookout	Lookout Security & Antivirus	4	2	2
com.mojang.minecraftpe	Minecraft	4	3	2
com.TWCableTV	Spectrum TV	4	2	2
com.mtvn.superbrawlapp	Super Brawl Universe	4	2	1
air.com.spilgames.TrollFaceQuestVideoGames2	Troll Face Quest: Video Games 2 - Tricky Puzzle	4	2	3
com.rvappstudios.abc_kids_toddler_tracing_phonics	ABC Kids - Tracing & Phonics	3	2	2
com.disney.docmcstuffinsbaby_goo	Doc McStuffins: Baby Nursery	3	2	2
com.rvappstudios.shapes.colors.toddler	Colors & Shapes - Kids Learn color and Shape	3	2	2
com.roblox.client	Roblox	3	2	3
com.rvappstudios.numbers123.toddler.counting.tracing	123 Numbers - Count & Tracing	3	2	2
com.google.android.videos	Google Play Movies & TV	3	3	2
org.lds.ldssa	Gospel Library	3	3	1
dk.spatifo.dublo	LEGO DUPLO Town	3	2	2
co.happybits.marcopolo	Marco Polo Video Walkie Talkie	3	2	3
com.sagosago.Friends.googleplay	Sago Mini Friends	3	1	3
com.rvappstudios.abc.spelling.toddler.spell.phonics	ABC Spelling - Spell & Phonics	3	2	2
com.nintendo.zaca	Animal Crossing: Pocket Camp	3	1	3

kr.co.smartstudy.babysharkrun_android_googlemarket	Baby Shark RUN	3	2	3
com.mobirix.swipebrick2	Bricks Breaker Quest	3	1	3
com.bubadu.bubbu	Bubbu - My Virtual Pet	3	1	3
se.appfamily.puzzle.christmas.free	Christmas Jigsaw Puzzles Game - Kids & Adults	3	1	3
com.roblox.cookie.dolls.swirl.surprise.videos.game	Crazy Cookie The Roblox Swirl: dolls adventures	3	2	2
com.peacock.flashlight	Flashlight	3	2	2
com.playdemic.golf.android	Golf Clash	3	2	2
kids.doodle.best.photo.apps	Kids Doodle	3	1	3
com.intellijoy.counting	Kids Learn to Count 123	3	2	2
com.game.flippy.knife.challenge	Knife 3D Game Challenge	3	2	2
com.lipalearning.lipatrain.game	Lipa Train	3	3	2
com.educastudio.marbelmewarnai	Marbel Kids Coloring Books	3	2	2
com.microsoft.office.onenote	Microsoft OneNote	3	1	3
com.kigle.project.poli.habit	Poli Habit Game	3	2	2
com.rvappstudios.jigsaw.puzzles.kids	Puzzle Kids - Animals Shapes and Jigsaw Puzzles	3	2	2
net.promediastudio.royalgirlspriincesssalon	Royal Girls - Princess Salon	3	2	2
com.moose.shopville	Shopkins World!	3	2	2
com.vitotechnology.StarWalk2Free	Star Walk 2 Free - Identify Stars in the Night Sky	3	2	2
com.touchmechanics.strike	Strike! Ten Pin Bowling	3	1	3
com.creaforkids.surpriseeggsgumballmachinekids	Surprise Eggs GumBall Machine	3	2	2
com.imangi.templerun2	Temple Run 2	3	1	3
com.outfit7.tomlovesangelafree	Tom Loves Angela	3	3	2
com.kidscape.king	Touch Lock - disable screen and all keys	3	1	3
air.com.spilgames.TrollFaceQuestHorror	Troll Face Quest: Horror	3	2	2
com.craftgames.worldcraft	WorldCraft: 3D Build & Craft	3	2	2

com.turner.gumballbkom	Wrecker's Revenge - Gumball	3	2	3
com.facebook.orca	Messenger: Text and Video Chat for Free	2	2	1
com.nianticlabs.pokemongo	Pokemon GO	2	2	2
com.robtopx.geometrydashsubzero	Geometry Dash SubZero	2	1	2
com.facebook.talk	Messenger Kids - Safer Messaging and Video chat	2	2	1
mobi.abcmouse.mathmastery.google	ABCmouse Mastering Math	2	1	2
mobi.abcmousemv.academy_google	ABCmouse Music Videos	2	1	2
com.amazon.kindle	Amazon Kindle	2	1	2
com.drivemode	AT&T DriveMode	2	2	1
com.bubadu.buildergame	Builder Game	2	1	2
com.cec.skateuniverse	Chuck E.'s Skate Universe	2	1	1
com.cocoplay.cocoiceprincess_googleplay	Coco Ice Princess	2	2	1
com.google.android.apps.books	Google Play Books - Ebooks, Audiobooks, and Comics	2	2	2
com.google.android.talk	Hangouts	2	2	1
com.hoopladigital.android	Hoopla Digital	2	2	1
com.internetdesignzone.nurseryrhymes	KidloLand- Nursery Rhymes, Kids Games, Baby Songs	2	2	2
com.alldigital.android.livingscriptures	Living Scriptures	2	2	1
com.AndroidA.MediaConverter	Media Converter	2	1	1
com.bubadu.mybabycare	My Baby Care	2	1	2
com.babyfirsttv.peekaboo_i_see_you	Peekaboo, I See You! for Kids	2	2	1
si.pilcom.apps.pizzamakerkids	Pizza Maker - Cooking Game	2	1	2
me.pou.app	Pou	2	1	2
com.tencent.ig	PUBG MOBILE	2	1	2

com.FDGEEntertainment.redball4.gp	Red Ball 4	2	2	1
com.roku.remote	Roku	2	2	1
com.samsung.smartviewad	Samsung Smart View	2	2	1
com.smule.singandroid	Smule - The #1 Singing App	2	1	2
com.sega.sonicboomandroid	Sonic Dash 2: Sonic Boom	2	2	1
com.ammonite.spaceforgecardboard	Spaceforge VR Google Cardboard	2	2	2
com.mstfbs.yesiluzayli	The gren alien dance	2	1	2
com.tocaboca.blocks	Toca Blocks	2	2	1
com.tocaboca.tocacity	Toca Life: City	2	2	1
com.tocaboca.tocalifeworld	Toca Life: World	2	2	2
com.UCMobile.intl	UC Browser - Video Downloader, Watch Video Offline	2	1	2
best.photo.app.unicornphoto	Unicorn Photo	2	1	2
com.verizon.messaging.vzmsgs	Verizon Messages	2	2	1
com.disney.wheresmywater2_go	Where's My Water? 2	2	1	2
es.parrotgames.restaurantcity	World Chef	2	2	1
com.zenstudios.ZenPinball	Zen Pinball	2	1	2
com.google.android.youtube	YouTube	1	1	1
com.tocaboca.tocakitchen2	Toca Kitchen 2	1	1	1
com.kiddoware.kidsplace	Kids Place - Parental Control	1	1	1
imanimation.alisumaya	Ali and Sumaya: Let's Pray!	1	1	1
com.disney.djappisodesmmchr_goo	Appisodes: Road Rally	1	1	1
com.demirm.bubble.popping.marine	Bubble Popping for Babies FREE	1	1	1
com.YovoGames.carwash3	Car Wash - Monster Truck	1	1	1
com.mytona.cookingdiary.android	Cooking Diary: Best Tasty Restaurant & Cafe Game	1	1	1
com.playrix.fishdomdd.gplay	Fishdom	1	1	1
com.google.android.apps.docs.editors.docs	Google Docs	1	1	1

com.chartcross.gpstest	GPS Test	1	1	1
com.bigbluebubble.singingmonsters.full	My Singing Monsters	1	1	1
com.androidwasabi.livewallpaper.g2nightsky	Night Sky Live Wallpaper	1	1	1
com.kidspaint.kaushalmehra.drawingfun	Paint Free - Drawing Fun	1	1	1
com.apptxx.ramp.car.racing	Ramp Car Stunts	1	1	1
com.kiddoware.kidsafebrowser	Safe Browser Parental Control - Blocks Adult Sites	1	1	1
com.zakg.scaryteacher.hellgame	Scary Teacher 3D	1	1	1
com.stingray.karaoke.smc	Singing Machine Karaoke	1	1	1
com.tocaboca.tocahairsalon3	Toca Hair Salon 3	1	1	1
com.tocaboca.tocanature	Toca Nature	1	1	1
com.tocaboca.tocapetdoctor	Toca Pet Doctor	1	1	1
com.matteljv.uno	UNO!	1	1	1
air.com.pixelstudio8.venom.angry.crash.rush.io.online	Venom Angry Crashy Rush Online	1	1	1
com.google.android.apps.youtube.unplugged	YouTube TV - Watch & Record Live TV	1	1	1
com.openlattice.chronicle	Chronicle	0	0	0
com.android.chrome	Google Chrome: Fast & Secure	0	0	0
com.google.android.apps.youtube.kids	YouTube Kids	0	0	0
com.google.android.googlequicksearchbox	Google	0	0	0
com.google.android.gms	Google Play Services	0	0	0
com.netflix.mediaclient	Netflix	0	0	0
com.google.android.play.games	Google Play Games	0	0	0
com.google.android.gm	Gmail	0	0	0
com.sec.android.app.sbrowser	Samsung Internet Browser	0	0	0
org.pbskids.gamesapp	PBS KIDS Games	0	0	0
org.pbskids.video	PBS KIDS Video	0	0	0
com.google.android.apps.docs	Google Drive	0	0	0
com.outfit7.mytalkingtom2	My Talking Tom 2	0	0	0

com.google.android.apps.photos	Google Photos	0	0	0
com.facebook.katana	Facebook	0	0	0
com.google.android.apps.maps	Google Maps	0	0	0
com.lego.duplo.trains	LEGO DUPLO Train	0	0	0
com.lego.bricksmore	LEGO Juniors Create & Cruise	0	0	0
com.happymeal.mcplay	McPlay	0	0	0
com.budgestudios.googleplay.MyLittlePonyRainbowRunners	My Little Pony Rainbow Runners	0	0	0
com.nick.android.nickjr	Nick Jr. - Shows & Games	0	0	0
io.voodoo.paper2	Paper.io 2	0	0	0
com.snapchat.android	Snapchat	0	0	0
com.budgestudios.googleplay.StrawberryShortcakeIceCreamIsland	Strawberry Shortcake Ice Cream Island	0	0	0
com.teachyourmonstertoread.tmapp	Teach Your Monster to Read - Phonics and Reading	0	0	0
com.powernapps.acallfromsanta	A Call From Santa Claus!	0	0	0
com.sinyee.babybus.tailor	Baby Panda's Fashion Dress Up Game	0	0	0
com.google.android.deskclock	Clock	0	0	0
com.play.dino.jurassic.world.app	Dinosaurs Hunter	0	0	0
flipboard.boxer.app	Flipboard Briefing	0	0	0
se.appfamily.dinoadventure	Kids Dino Adventure Game - Free Game for Children	0	0	0
com.lego.superheroes.dccomics.mightymicros	LEGO DC Mighty Micros	0	0	0
com.razmobi.monstertrucks2	Monster Trucks Game for Kids 2	0	0	0
com.bandainamcoent.google.pac.ralph	PAC-MAN: Ralph Breaks the Maze	0	0	0
com.samsung.oh	Samsung Members	0	0	0
air.com.hypah.io.slither	slither.io	0	0	0
com.sega.soniccd.classic	Sonic CD Classic	0	0	0
com.sega.sonic4episode2	Sonic The Hedgehog 4 Episode II	0	0	0

com.pablo.gallegoFalcon.PDLNormalES	Spanish Lucas' Whiteboard	0	0	0
com.budgetstudios.googleplay.ThomasAndFriendsMinis	Thomas & Friends Minis	0	0	0
com.ction.playergames	2 3 4 Player Mini Games	0	0	0
com.iabuzz.apk.p4kall	384 Puzzles for Preschool Kids	0	0	0
com.piano3d.piano.pianokeyboard	3D Piano Keyboard	0	0	0
com.foofoo.tracing	ABC Tracing & Phonics Game for Kids & Preschoolers	0	0	0
com.sinyee.babybus.foodstuff	Baby Panda's Fruit Farm	0	0	0
com.budgetstudios.BarbieMagicalFashion	Barbie Magical Fashion	0	0	0
com.oceanhouse_media.bookbbweloveourmom_app	BB - We Love Our Mom	0	0	0
com.gamehivecorp.beattheboss4	Beat the Boss 4	0	0	0
com.goodssofttech.puzzlesforkids	Bob - jigsaw puzzles free games for kids & parents	0	0	0
game.free.rise.hole.up.io.love.balls.toss.up	Buddy Toss	0	0	0
com.appear.cakeonfaceantistresses	Cake on face antistress	0	0	0
com.freegame.carsmasher	Car Smasher	0	0	0
air.com.CaringForPuppySalon	Caring for puppy salon	0	0	0
com.turner.cnplay	Cartoon Network Arcade	0	0	0
com.wonderfulgames.catthemedamusementparkfun	Cat Theme & Amusement Park Fun	0	0	0
com.uilmedia.chasecraft	Chasecraft	0	0	0
air.com.foxandsheep.chomp	CHOMP by Christoph Niemann	0	0	0
com.choochooapps.cboo	Choo Choo Boo	0	0	0
com.choochooapps.cfarm	Choo Choo Farm	0	0	0
com.orange.coloring.book.christmas.kids	Christmas Coloring Book	0	0	0
classickong.retroclassic	classic kong	0	0	0
com.naturalmotion.clumsyninja	Clumsy Ninja	0	0	0

com.orange.coloring.learn.kids	Coloring & Learn	0	0	0
com.bimiboo.coloring	Coloring book for kids	0	0	0
com.kidscoloringbook.android	Coloring book moana	0	0	0
com.FDGEntertainment.CoverOrange2.gp	Cover Orange: Journey	0	0	0
com.topgamestudio.CubeWarsBattlefieldSurvival	Cube Wars Battle Survival	0	0	0
com.km.cutpaste.util	Cut Paste Photos	0	0	0
com.appama.dinosaurmatchinggame	Dinosaur Matching Game for Kid	0	0	0
air.com.thirdsense.eggyWords100HD	Eggy 100 HD	0	0	0
com.elephanthead.elephantlearning	Elephant Learning Math Academy	0	0	0
com.originatorkids.EndlessAlphabet	Endless Alphabet	0	0	0
com.hasbro.MLPegWorldENTERPRISE	Equestria Girls	0	0	0
com.NikSanTech.FireDots3D	Fire Balls 3D	0	0	0
org.mozilla.firefox	Firefox Browser fast & private	0	0	0
com.duckduckmoosedesign.fish	Fish School by Duck Duck Moose	0	0	0
com.AppKingdom.fivemonkeys videos	Five Little Monkeys Videos	0	0	0
com.google.android.apps.kids.familylink	Google Family Link for parents	0	0	0
com.google.android.apps.kids.familylinkhelper	Google Family Link for children & teens	0	0	0
com.google.android.keep	Google Keep	0	0	0
com.google.android.apps.paidtasks	Google Opinion Rewards	0	0	0
air.com.bmapps.gossipgirlsdivasinhighschool	Gossip Girl Divas in Highschool	0	0	0
com.DrHackAndMatrixDeveloper.grandson	Grandson	0	0	0
com.green.alien.dance.button	Green alien dance button	0	0	0
com.futureplay.boots	Idle Farming Empire	0	0	0

air.com.bmapps.injureddolphincare	Injured Dolphin Care	0	0	0
org.jw.jwlibrary.mobile	JW Library	0	0	0
com.playgendary.ktb2	Kick the Buddy: Forever	0	0	0
com.learninga_z.onyourown	Kids A-Z	0	0	0
se.appfamily.balloonpopfree	Kids Balloon Pop Game Free	0	0	0
com.extwebtech.kidslearningplanet	Kids Preschool	0	0	0
com.CoolAwesomeFun.KidsRacing	Kids Racing - FunRacecar Game For Boys And Girls	0	0	0
air.fisherprice.com.Puppy	Learning Letters Puppy	0	0	0
com.lightbot.lightbot	Lightbot: Programming Puzzles	0	0	0
air.com.winkypinky.babybellabraidhairstalon	Little Bella Braided Hair Salon	0	0	0
com.sinyee.babybus.village	Little Panda's Dream Town	0	0	0
com.facebook.mlite	Messenger Lite: Free Calls & Messages	0	0	0
com.SlidePuzzle	Minecraft Portals Puzzle for fun	0	0	0
com.telltalegames.minecraft100	Minecraft: Story Mode	0	0	0
com.appblockgames.freecraftexploration	MOD-MASTER for Minecraft PE (Pocket Edition) Free	0	0	0
com.speedygtgames.motorcyclescapesimulatorformulacarpolice	motorcycle Escape Simulator; Formular Car - Police	0	0	0
com.tutotoons.app.mybabyunicorn.free	My Baby Unicorn - Virtual Pony Pet Care & Dress Up	0	0	0
com.gameloft.android.ANMP.GloftPOHM	MY LITTLE PONY: Magic Princess	0	0	0
com.symantec.applock	Norton App Lock	0	0	0
air.org.pbskids.playandlearn	PBS Parents play & Learn	0	0	0
air.com.pepiplay.pelitree	Pepi Tree	0	0	0
air.com.peppapig.activitymaker	Peppa Pig: Activity Maker	0	0	0
air.com.peppapig.paintbox	Peppa Pig: Paintbox	0	0	0
com.vacuapps.jellify	Photos Alive - Jellify	0	0	0

com.custom.pickmeup	Pick Me Up	0	0	0
kr.co.smartstudy.babyshark_android_googlemarket	Pinkfong Baby Shark	0	0	0
com.pjmask.web	PJ Masks: HQ	0	0	0
com.playmobil.ghostbusters	PLAYMOBIL Ghostbusters™	0	0	0
com.tellurionmobile.realmcraft	RealmCraft with Skins Export to Minecraft	0	0	0
com.gamepig.rush	Rolling Balls	0	0	0
com.sagosago.ForestFlyer.googleplay	Sago Mini Forest Flyer	0	0	0
com.sagosago.SpaceExplorer.googleplay	Sago Mini Space Explorer	0	0	0
com.sagosago.FairyTales.googleplay	Sago Mini Fairy Tales	0	0	0
com.sec.android.app.shealth	Samsung Health	0	0	0
smellymoo.sand	sand:box - relaxing particle engine	0	0	0
com.wb.goog.scribblremix	Scribblenauts Remix	0	0	0
air.Mark.MemoryGameForKids	Simon Says Memory Game	0	0	0
com.simplemobiletools.draw	Simple Draw	0	0	0
com.adsk.sketchbook	SketchBook: draw and paint	0	0	0
com.samsung.android.oneconnect	SmartThings (Samsung Connect)	0	0	0
ru.brothersappsandgames.smashdiyslimesfidgetslimy	Smash Diy Slime - Fidget Slimy	0	0	0
air.com.starfall.more	Starfall Free & Member	0	0	0
com.darkarrow.stickfighter.saiyan	Stick Shadow: War Fight	0	0	0
com.maxgames.stickwarlegacy	Stick War: Legacy	0	0	0
com.mindy.grapl	Stickman Hook	0	0	0
air.ie.capture.fisherprice3	Storybook Rhymes Volume 3	0	0	0
com.budgetstudios.StrawberryShortcakeBakeShare	Strawberry Shortcake Bake Shop	0	0	0
com.tutotoons.app.sweetbabygirlnewborn2.free	Sweet Baby Girl Newborn 2	0	0	0
com.synthesia.synthesia	Synthesia	0	0	0

com.imangi.templerun	Temple Run	0	0	0
com.budgetstudios.ThomasAndFriendsGoGoThomas	Thomas & Friends: Go Go Thomas	0	0	0
com.bimiboo.playandlearn	Toddler games for 2-5 year olds	0	0	0
br.com.tapps.toiletttime	Toilet Time - Minigames to Kill Bathroom Boredom	0	0	0
io.mrarm.mctoolbox	Toolbox for Minecraft: PE	0	0	0
com.orionsmason.trainpuzzle	Train Games for Kids- Puzzles	0	0	0
com.tronrider	Tron Racer	0	0	0
com.duckduckmoosedesign.trucks	Trucks by Duck Duck Moose	0	0	0
com.perfectedtech.tumblebooks	Tumblebooks	0	0	0
org.videolan.vlc	VLC for Android	0	0	0
com.water.surfingrace.motorbike.stunt	Water Surfing motorbike Stunt	0	0	0
com.duckduckmoosedesign.bus	Wheels on the Bus	0	0	0
com.oceanhouse_media.bookclwhenigrowup_app	When I Grow Up	0	0	0
com.ttqq.wild.west.craft.creative.survival	Wild West Craft - Mini West World	0	0	0

<sup>a</sup>Information sorted by number of transmissions, high to low.

**eTable 2. Transmission and Domain Counts by DFF Status and App Popularity**

<b>Data Variable</b>	<b>Transmission Count Median [IQR]</b>	<b>Domain Count Median [IQR]</b>	<b>Unique Data Types Median [IQR]</b>
DFF Status			
In DFF	1.0 [0-5]***	1.0 [0-3]***	1.0 [0-2]***
Not in DFF	4.0 [0-14]	3.0 [0-9]	2.0 [0-2]
Popularity Status			
Top 10%	0 [0-5]**	0 [0-3]**	0 [0-2]*
Bottom 90%	3.0 [0-10]	2.0 [0-6]	2.0 [0-2]

Bivariate associations: \*\*\*p <.001, \*\*p<.01, \*p<.05, †p<.20

**eTable 3. Top 50 Most Common Third-Party Domains to Which Identifiers Were Transmitted by Apps Analyzed in the Current Study**

<b>domain</b>	<b>Number of persistent identifier transmissions</b>	<b>Number of unique apps</b>	<b>Researcher notes re: type of domain based on website review</b>
graph.facebook.com	103	103	"Object information" (about individual users) and marketing
config.uca.cloud.unity3d.com	86	83	Advertising
auction.unityads.unity3d.com	103	79	Advertising
publisher-config.unityads.unity3d.com	83	79	Advertising
cdp.cloud.unity3d.com	138	73	Game hosting platform, has ad services
logs.supersonic.com	51	45	Advertising
t.appsflyer.com	84	44	Marketing analytics
live.chartboost.com	125	43	In-app monetization and ads
rv-gateway.supersonicads.com	44	42	Advertising
adc3-launch.adcolony.com	71	40	Advertising
outcome.supersonicads.com	49	38	Advertising and app monetization
wd.adcolony.com	48	37	Advertising
settings.crashlytics.com	61	34	App analytics - crashing, growth, retention, engagement
ads30.adcolony.com	41	34	Advertising
ecommerce.iap.unity3d.com	34	34	Advertising
is-gateway.supersonicads.com	41	32	Advertising
api.vungle.com	33	30	Ads/monetization
init.supersonicads.com	33	30	Advertising
ws.tapjoyads.com	53	27	Advertising
connect.tapjoy.com	51	27	Advertising
app.adjust.com	32	27	Measures mobile marketing, integrates with over 2000 ad networks for "granular insights" across platforms.
rpc.tapjoy.com	58	26	Advertising
ads.api.vungle.com	26	26	Ads/monetization
placements.tapjoy.com	57	24	Advertising
ads.mopub.com	34	23	Advertising
outcome-ssp.supersonicads.com	38	22	Advertising
a.applovin.com	24	22	Monetization, "get access to more buyers and higher eCPMs"
static.ssacdn.com	22	22	Couldn't find

data.flurry.com	40	21	App analytics and 'promotions'. States allows apps to 'target users' and behavioral messaging based on user behavior and demographic information
track.atom-data.io	25	21	Data collection/management- "query and manage data sources"
content.tapjoy.com	36	20	Advertising
impression.appsflyer.com	31	20	Advertising
d.applovin.com	18	18	Monetization, "get access to more buyers and higher eCPMs"
events.appsflyer.com	74	16	Marketing analytics
stats.unity3d.com	20	14	Advertising
api.gameanalytics.com	29	12	Player tracking
setting.rayjump.com	18	12	Couldn't find
analytics.rayjump.com	12	12	Couldn't find
rt.applovin.com	13	11	Advertising
vast.kidoz.net	12	11	In-app monetization
publisher-event.unityads.unity3d.com	11	11	Advertising
control.kochava.com	26	10	"People-based" marketing - "enrich user identities, segment and activate audiences, and measure and optimize their campaigns"
api.uca.cloud.unity3d.com	20	10	Advertising
impact.applifier.com	11	10	Cross-promotion network for social games and apps - acquired by unity
click-haproxy.supersonicads.com	10	10	Monetization and marketing
analytics.localytics.com	30	9	Mmobile app marketing and analytics
net.rayjump.com	16	9	Advertising
vast.streamrail.net	9	9	Platform with ad monetization and analytics
med.heyzap.com	18	8	Advertising
pssvc.iqzone.com	16	8	Links to multiple ad networks