# Google, Android and Location Tracking

December 2018

#### Executive Summary

- Google collects considerable amounts and variety of data from Android smartphones, with an emphasis on direct and indirect measures of sensitive location data.
- Google engineers the user choices on Android smartphones to ensure it can access sensitive location data via default settings and complex opt-out processes.
- Google uses Location Data to improve targeted advertising and metrics for advertisers, a key factor driving 86%<sup>1</sup> of Google's revenue.

Google systematically collects user data from its various products and services, including highly sensitive location data, and it takes extraordinary steps to both enable and preserve its ability to collect this information. The Android operating system is a key example – the process of turning off all services that track location is a complicated endeavor, and keeping them off while using a smartphone is unlikely. Users must navigate a maze of options to successfully turn off location services Google exposes to users, but even after these steps are taken Google continues to derive and collect user location information. Google openly admits to collecting the Internet Protocol (IP) address of devices – independent of a user's location. There is no unilateral user directed capability to stop Google from collecting location information – even if a user does not maintain a Google account.

Distributing location related settings across multiple Android smartphone settings, screens and services, Google makes it functionally difficult to turn off all location related services. During the critical Android smartphone setup process, users must navigate an opaque, confusing, and arduous process to determine the impact of each location service setting, all of which require users to "opt out" rather than "opt in" to data collection. Further, any effort to maintain a user's preference of "opting-out" of collection related to location services, is frustrated by constant system- and app-alerts prompting a user to enable location services.

A person's pattern of life – the daily rhythm of the people and places individuals spend time with in the real world – combined with their online web browsing and search history creates a detailed dossier of their lifestyle. Google uses this data to develop a super-profile on users which is continuously updated. Combining multiple sources of user data across its products and services, the pool of data is used to power Google's digital advertising products, responsible for 86%<sup>2</sup> of Google's revenue.

<sup>&</sup>lt;sup>1</sup> https://abc.xyz/investor/static/pdf/20171231\_alphabet\_10K.pdf?cache=7ac82f7

<sup>&</sup>lt;sup>2</sup> https://abc.xyz/investor/static/pdf/20171231\_alphabet\_10K.pdf?cache=7ac82f7

# 1) How Google Tracks Location of Android Users

Google's Android Operating System nests location controls under multiple different settings (Figure 1). In order to make informed decisions regarding which location services to enable, users must first understand the differences between these settings (Figure 1). Furthermore, a user must understand which of these settings have account-level or device-level effect.

FUNCTION	SETTING LEVEL	DESCRIPTION	OPT-IN / OPT-OUT	USER CHOICES
LOCATION HISTORY	Account	"[A]llows Google to store a history of your location data from all devices where you are logged into your Google Account and have enabled Location Reporting. Location History and Location Reporting data may be used by any Google app or service."	Opt-Out	"YES, I'M IN" or "NO THANKS" In the context of "Give your new Assistant permission to help you"
WEB & APP ACTIVITY	Account	Saves your searches, Chrome browsing History and activity from sites and apps that use google services to give you better search results, suggestions, and personalization across Google services.	Opt-Out	Save my Web & App Acivity to my Google account" or "Don't save my Web & App Activity to my Google Account" Users also have to opt to view "More Options" when agreeing to the Google Privacy Policy and Terms of Service during Set-Up to see these options.
LOCATION SERVICES	Device	"Use Google's location service to help apps determine your location. Anony- mous location data will be sent to Google when your device is on."	Opt-Out	"YES, I'M IN" or "SKIP"
LOCATION ACCURACY	Device	Three Modes - "High accuracy", "Battery saving", and "Device only." Default setting: "High accuracy use[s] GPS, Wi-Fi, Bluetooth, or cellular networks to determine location"	Opt-Out	Toggle icon (right and colored for on, left and gray for off). This setting not shown during Android set-up.
LOCATION SCANNING	Device	"Improve location accuracy by allow- ing apps and services to scan for Wi-Fi and Bluetooth, even when those settings are off."	Opt-Out	Toggle icon (right and colored for on, left and gray for off).

Figure 1: Six Android settings and services for collection of location information.<sup>3</sup>

#### Account- Level Settings and Device-Level Settings

Various Google products and services have configuration settings that operate at account-level and device-level scope, adding complexity to user control over location tracking. Google defaults users into highly accurate location settings during set-up of their Android device. Controls for these settings are spread across various screens and prompts – some accessible locally on an Android device, others requiring a user to navigate to their Google Account settings website, all but ensuring that users will maintain those settings after set-up of their Android device.

<sup>&</sup>lt;sup>3</sup> Location Accuracy and Location Scanning are additional sub-settings that rely on Location Services. If Location Services is turned off, users are unable to access Location Accuracy and Location Scanning settings. "Descriptions" explained here are taken from Google's own descriptions and prompts.

Account-level settings operate independently of device-level settings. When a consumer adjusts an account-level setting, the new setting applies to the account for that service and will take effect across all devices where the user is logged into her Google account, for example Gmail, Google Chrome, Google Maps, YouTube, etc. A device-level setting change is limited to the specific item of hardware where the consumer made the adjustment.

Consumers are prompted to create a Google Account during the setup process of an Android smartphone. Once a consumer creates a Google account it can be used to sign into *all* Google Services (G-Mail, Youtube, etc.).

- A setting on any device in which a user is logged into a Google Account will govern all devices for which a consumer is logged in by default.
- Location History and Web & App Activity are both Google Account-Level settings.
- Location History is enabled across devices by default when turned on, however; a user can disable Location History on an individual device while keeping the service enabled at an Account Level.
- Web & App Activity cannot be disabled on a specific device.

#### **Google Location History**

Location History tracks a consumer across all of the devices they may use (a smartphone, PC, laptop, tablet, smart television, etc.) when logged into their Google account. When enabled on a smartphone, a user's location and various characteristics about a user's movements over time (such as walking, driving, or biking) are recorded and transmitted to Google. Google describes Location History as having a number of benefits, "including

#### Google Web & App Activity

Google also operates a service that collects user data via its "Web and App Activity" setting for the purposes of "better search results and suggestions."<sup>5</sup> During an Android device setup process, Google opts in users to this account-level setting by default. With Web and App Activity tracking enabled, Google combines user behavior on the web, such as searches, across multiple devices, so long as those devices are signed in using the same account. While not disclosed during initial Android device setup, Web and App Activity settings also track user location via their IP address, and via a user's activity such as searching for a location on Google Maps.

#### **Google Location Services**

Google Location Services (GLS) operates at the device level and relies on GPS, Wi-Fi, the cellular radio, and other technologies to position a user in the world. If a user keeps the default settings as prompted by Google, Location Services is enabled, Location Accuracy is set to "High

<sup>&</sup>lt;sup>4</sup> https://support.google.com/accounts/answer/3118687?hl=en

<sup>&</sup>lt;sup>5</sup> https://support.google.com/websearch/answer/54068

Accuracy"<sup>6</sup> and Location Scanning<sup>7</sup> is enabled.<sup>8</sup> Google's Privacy Policy notes "information about things near your device"<sup>9</sup> is used to help establish location (Figure 2), including the location of privately owned Wi-Fi base stations,<sup>10</sup> mobile hotspots, and Bluetooth beacons.<sup>11</sup>

Information about things near your device If you use Google's Location services on Android, we can improve the performance of apps that rely on your location, like Google Maps. If you use Google's Location services, your device sends information to Google about its location, sensors (like accelerometer), and nearby cell towers and Wi-Fi access points (like MAC address and signal strength). All these things help to determine your location. You can use your device settings to enable Google Location services. Learn more

Figure 2: Google Privacy Policy Location Disclosure

## 2) Google Location Tracking is Not "Opt-In"

During setup of an Android smartphone users are must opt-out of location tracking. These settings are difficult to disable permanently, as users are constantly prompted to enable location tracking capability. Google claims that "users have the ability to opt into GLS when setting up their device or when using an application that uses GLS."<sup>12</sup> In practice, users are

<sup>&</sup>lt;sup>6</sup> Phone will use GPS, Wi-Fi, Bluetooth, or mobile networks to determine location.

<sup>&</sup>lt;sup>7</sup> Location Scanning works in the background and even if a user turns off Wi-Fi and Bluetooth, data about surrounding base stations and beacons will be reported back to Google.

<sup>&</sup>lt;sup>8</sup> <u>https://qz.com/1169760/phone-data/</u>

<sup>&</sup>lt;sup>9</sup> https://policies.google.com/privacy?hl=en&gl=ZZ

<sup>&</sup>lt;sup>10</sup> Including a Wi-Fi base station's unique Media Access Control (MAC) address<sup>10</sup> and signal strength.

<sup>&</sup>lt;sup>11</sup> Google collects this information when a Google Android user is in the vicinity of these signals, including from devices that do not use Google services or from consumers who may not have agreed to Google's Terms of Service and Privacy Policy.

<sup>&</sup>lt;sup>12</sup> Google's response to Senators Blumenthal and Markey, page 2, paragraph 5

required to "opt-out" during the setup of an Android phone - Figure 3<sup>13</sup> displays screenshots taken during the initial setup process of an Android device by a new user.

Directly contradicting Google claims that users "opt-in" to GLS, Figure 3 shows all Android smartphone setup choices for sharing location information with Google are pre-configured for the "on" setting – the canonical definition of user "opt-out." Rather than being explicitly asked to accept these preselected options, users are prompted to click "next." By clicking through this series of screens a user, by default, configures their Android device to enable the constant monitoring of their location using GPS, data pulled from the sensors on a phone, and information about connected devices within range of the phone, such as Wi-Fi MAC address and Bluetooth beacons.<sup>14</sup>



Figure 3: Google Services Defaults During Android Device Setup

Continuing through the Android smartphone setup process, users are prompted to enable **Google Assistant**<sup>15</sup> – a choice that if selected enables Location History, collection of device information, and recording of voice and audio activity of the user. Figure 4 displays the screenshots for setup of the Google Assistant service, bundling multiple settings with one "Yes

<sup>&</sup>lt;sup>13</sup> The screenshots in this paper reflect the setup on a Google Pixel 2 running Android 8.1.0.

<sup>&</sup>lt;sup>14</sup> <u>https://policies.google.com/privacy#infocollect</u>

<sup>&</sup>lt;sup>15</sup> <u>https://assistant.google.com</u>

I'm In." These default settings for Google Assistant also meet the criteria for an "opt-out" process, in direct conflict with Google's statement that "users must opt-in to this service."<sup>16</sup>



Figure 4: Google Assistant Setup Screens

After completing the setup process users can validate and control settings for device location via the Settings app and navigating to Google settings, then Location (Figure 5).



<sup>&</sup>lt;sup>16</sup> Google's response to Senators Blumenthal and Markey, page 8, paragraph 5

As demonstrated in Figure 5, if users accept Google's defaults during the setup process, the Android device is configured with Location Services enabled, Wi-Fi and Bluetooth Scanning engaged, and Location History active.<sup>17</sup>

Google gives user only the illusion of choice: **opt-out** and lose the functionality of their smartphone or **accept defaults** and have every move constantly monitored, tracked, and recorded. If a user decides to disable location services, a warning dialogue box prompts an extreme scenario: "device location for all apps is turned off and you may not be able to locate your device if it is lost." (Figure 6)

If a user disables Location Services but then attempts to use a location aware app or service on their device, they will see the dialogue box shown in Figure 7. If the user clicks "OK" the location service is enabled for the entire device and permanently, rather than enabling Location Services only for that particular app or service that is requesting the functionality.



Location History settings are similarly designed to prompt users to enable the service and direct a stream of location data to Google. Figure 8 is a screenshot of the first time Google's Map app is launched. Note that Google prompts the user to enable Location History if it is disabled, providing two options, "Yes, I'm in" or "Skip." Users are informed that "Google needs to periodically store your location," yet are given options where the "Skip" button blends in to the

<sup>&</sup>lt;sup>17</sup> See Annex A

background. If the user selects the highlighted option, they turn on Location History (an account-level setting) universally across all devices associated with their Google account.

It is reasonable to expect that when Location History is disabled on one device, Google will not collect and store historical location on a user from that device. In practice, however, this is not the case.



Figure 8: Location History Prompt

The Associated Press reported that Google in fact tracks historical locations of users who have Location History disabled on their smartphones. <sup>18</sup> This location tracking is a result of Google *also* tracking and storing user location across devices through its "Web & App Activity" setting. This setting is enabled by default to collect information across devices on an account (Figure 9).

<sup>&</sup>lt;sup>18</sup> <u>https://apnews.com/828aefab64d4411bac257a07c1af0ecb</u>



The "Web & App Activity" setting does not disclose location tracking during the setup process, even if a user selects the "learn more" link (Figure 10). Additional information about the setting is available on Google's Account Activity Controls website, after a user makes three navigation choices. <sup>19</sup> (Figure 11)

fo about your searches & r	more	^
When Web & App Activity is o	on, Google saves information like:	
• Searches and other things	you do on Google products and services, like M	aps
Your location, language, IP	address, referrer, and whether you use a brows	er or an app
Ads you click, or things you	u buy on an advertiser's site	
Information on your device	e like recent apps or contact names you searche	d for
Note: Activity could be saved	l even when you're offline.	

Figure 11: It takes multiple clicks to learn Google tracks your location with this setting.

<sup>&</sup>lt;sup>19</sup> https://support.google.com/websearch/answer/54068?p=web\_app\_activity&co=GENIE.Platform%3DAndroid&oco=1

The language detailing what happens when a consumer changes their Location History setting was modified by Google in response to an Associated Press report (Figure 12). Despite the first sentence noting "You can turn off Location History at the account level at any time," Google discloses location data will continue to be collected and saved by Google in the third sentence. These statements are at best confusing, providing consumers with the illusion of control, while redefining the term "off" to mean "on."

# Turn Location History on or off

You can turn off Location History at the account level at any time.

This setting does not affect other location services on your device, like Google Location Services and Find My Device. Some location data may be saved as part of your activity on other services, like Search and Maps. When you turn off Location History for your Google Account, it's off for all devices associated with that Google Account.

Figure 12: Google's Updated Disclosure (after Associated Press report)<sup>20</sup>

According to Google, a user can turn "Web and App Activity" on or off by taking the following steps (Figure 13):

# Turn Web & App Activity on or off 1. Depending on your device, open Google settings in one of these places: Settings app Google Google Settings On some Android devices, open your Settings app > tap General. 2. Tap Personal info & privacy > Activity controls > Web & App Activity. 3. Turn Web & App Activity on or off. 4. If you turn the switch on, you can check the box next to "Include Chrome browsing history and activity from websites and apps that use Google services." When this box is checked, you can control whether app activity from your device is saved. 5. Optional: To choose whether app activity from your device is saved, tap Data from this device, then tap the switch or checkbox.

Note: Some browsers and devices may have more settings that affect how this activity is saved.

Figure 13: Google's Instructions for Web & App Activity Control<sup>21</sup>

In contrast, the six screenshots of Figure 14 reflect the *actual* steps an Android user must take in order to change their "Web and App Activity" settings, which when enabled also track, store and send a user's location to Google.<sup>22</sup>

<sup>&</sup>lt;sup>20</sup> <u>https://support.google.com/accounts/answer/3118687?p=privpol\_lochistory&visit\_id=636703138939910406-3172221135&rd=1</u>

<sup>&</sup>lt;sup>21</sup>https://support.google.com/websearch/answer/54068?p=web\_app\_activity&hl=en&authuser=0&visit\_id=63669 9552478272972-2174117461&rd=1&co=GENIE.Platform%3DAndroid&oco=1

<sup>&</sup>lt;sup>22</sup> Screenshots taken on 16 August 2018 on a Google Pixel 2 running Android 8.1.0

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Figure 14: User steps to change Web and App Activity setting

# 3) Consumers Unable to Fully Disable Location Tracking

Google explains in a variety of public communications, including their privacy policy,<sup>23</sup> (Figure 15) blog posts targeted at advertisers,<sup>24</sup> and in a letter to the United States Senate,<sup>25</sup> that the company uses IP Addresses to locate consumers. Location information of consumers is collected on websites that use Google services including DoubleClick and Google Analytics via their IP address; this form of location tracking cannot be disabled by the consumer.

Specific to Android, Google notes that for the operation of messaging and notification systems "it is important for a device to keep its connection alive for as long as possible", and as a result, "Android devices and servers send pings to each other (referred to as "heartbeats")."<sup>26</sup> These device "heartbeats" disclose the user's Android device IP address to Google independently of any location related user device settings. As a result, Android users cannot opt out of Google tracking their location.



Figure 15: Portion of Google Privacy Policy Detailing IP Address Based Location Determination<sup>27</sup>

<sup>&</sup>lt;sup>23</sup> <u>https://policies.google.com/privacy?hl=en</u>

<sup>&</sup>lt;sup>24</sup> <u>https://support.google.com/google-ads/answer/2453995?hl=en</u>

<sup>&</sup>lt;sup>25</sup> Google's response to Senators Blumenthal and Markey, page 7, paragraph 5 and 6

<sup>&</sup>lt;sup>26</sup> Google's response to Senators Blumenthal and Markey, page 7, paragraph 5 and 6

<sup>&</sup>lt;sup>27</sup> <u>https://policies.google.com/privacy#footnote-ip</u>

# 4) Google Collects Additional Consumer Activity Data Beyond Location

Individuals are not likely to turn off location services Google pre-selects – nine in ten US smartphone owners use location-based services on their phone.<sup>28</sup> If an Android user does manage to opt-out (and continue to remain so), Google continues to collect a vast array of information about an individual's online activity<sup>29</sup> including:

- Terms you search for
- Videos you watch
- Views and interactions with content and ads
- Voice and audio information when you use audio features
- Purchase activity
- People with whom you communicate or share content
- Activity on third-party sites and apps that use our services
- Chrome browsing history you've synced with your Google Account
- Telephony log information like your phone number, calling-party number, receivingparty number, forwarding numbers, time and date of calls and messages, duration of calls, routing information, and types of calls

### 5) Why Does Google Track Location?

Google uses location information to sell targeted ads, (Figure 16) monetizing the data it collects to generate \$95 billion of annual advertising revenue. Individuals are tracked online and in the real world whether or not they have a Google Account, creating super-profile on nearly everyone.

User location and activity data from Android smartphones creates detailed profiles of realworld behavior and patterns of life. In their communications with advertisers, Google explains that they track an individual's location by using collected IP addresses, GPS, Wi-Fi, Bluetooth, and cellular towers.<sup>30</sup> A second-by-second record of an individual's every movement is highly sensitive, if not intimate, and Google uses the data to "close the loop,"<sup>31</sup> targeting ads while they go about their daily routine.

In addition to data collection through Android, Google tracks individuals via DoubleClick and Google Analytics.<sup>32</sup> DoubleClick cookies are associated with 1.6 million websites and 75% of the top 100,000 websites on the internet use Google Analytics.<sup>33</sup> These services were reorganized

<sup>&</sup>lt;sup>28</sup> <u>http://totalaccess.emarketer.com/Reports/Viewer.aspx?R=2001793&ecid=MX1086</u>

<sup>&</sup>lt;sup>29</sup> <u>https://policies.google.com/privacy#infocollect</u>

<sup>&</sup>lt;sup>30</sup> <u>https://support.google.com/google-ads/answer/2453995?hl=en</u>

<sup>&</sup>lt;sup>31</sup> https://adwords.googleblog.com/2016/09/New-Digital-Innovations-to-Close-the-Loop-for-Advertisers.html

<sup>&</sup>lt;sup>32</sup> <u>https://www.google.com/about/products/</u>

<sup>&</sup>lt;sup>33</sup> <u>https://trends.builtwith.com/analytics/Google-Analytics</u>

# in 2018; DoubleClick is now part of Google Ads which also includes the programmatic services formerly known as

### Where your users are located (physical location) The Google Ads system uses a number of factors to determine someone's physical location and whether to show your ad. When possible, we determine physical location based on someone's computer or mobile device location, or other methods. · IP address: Location is typically based on the Internet Protocol (IP) address, which is a unique number assigned by Internet Service Providers to each computer connected to the Internet. If a device is connected to a Wi-Fi network, we may detect the Wi-Fi network's IP address to determine physical location. If a mobile device is connected to a mobile carrier's proxy server, we may use the carrier IP to determine the device's location. Device location: Depending on a user's location settings, we may be able to use a precise location for advertising, based on one of these sources of location data: · GPS: Accuracy varies depending on GPS signal and connection. • Wi-Fi: Accuracy should be similar to the access range of a typical Wi-Fi router. · Bluetooth: If Bluetooth and/or Bluetooth scanning are enabled on a device, a publicly broadcast Bluetooth signal can provide an accurate indication of location · Google's cell ID (cell tower) location database: Used in the absence of Wi-Fi or GPS. Accuracy is dependent on how many cell towers are located within an area and available data, and some devices don't support cell ID location.

Figure 16: Google Ads Help Explanation Targeted Ads by Geolocation<sup>35</sup>

https://digitalcontentnext.org/wp-content/uploads/2018/08/DCN-Google-Data-Collection-Paper.pdf

<sup>&</sup>lt;sup>34</sup> <u>https://adexchanger.com/platforms/doubleclick-no-more-google-renames-its-ad-stack/</u>

<sup>&</sup>lt;sup>35</sup> https://support.google.com/google-ads/answer/2453995?hl=en