

How does the device use WiFi to determine your physical location?

Laptops and other mobile devices, even without GPS hardware, can still accurately determine your physical location with just a WiFi connection.

Did you know that laptops and other mobile devices, even without GPS hardware, can still relatively accurately determine your actual location with just a WiFi connection? Here's how this often overlooked feature of modern 'Location Services' works.

'Location Services' is more than just GPS

Modern operating systems — such as iOS, iPadOS, Android, Windows 10, macOS and Chrome OS — have a built-in location system called 'Location Services'.

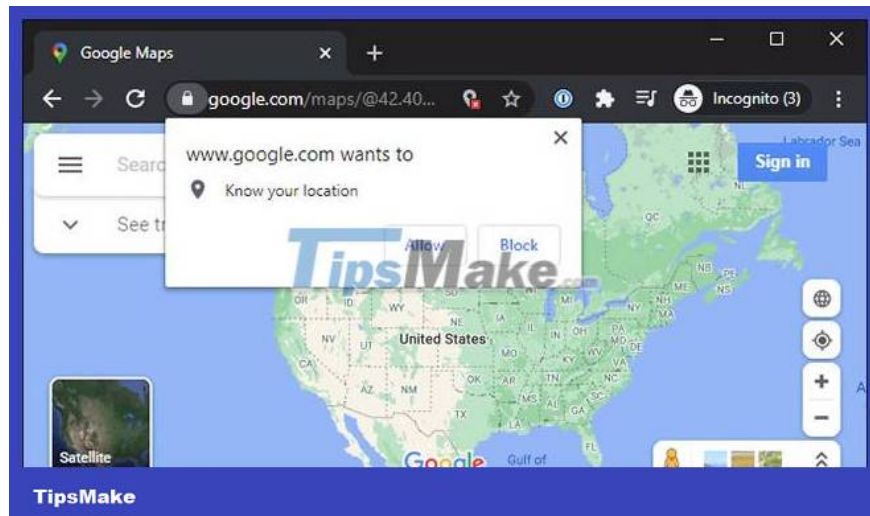
When an app — such as a maps or navigation app — requests access to your location, it doesn't just access your device's GPS system directly. Along with that, it also 'works' with the operating system's Location Services to determine exactly where you are.

Modern Location Services systems use many different techniques to find and determine the device's location. GPS is one of those techniques. However, when the GPS signal or GPS hardware is unavailable — or too slow — Location Services offers other tricks.

For example, if the device is connected to a mobile network signal (3G, 4G, 5G), your location can be determined through the signal from the cell tower. Based on the relative signal strengths from three different nearby cell towers, your actual location can be estimated fairly accurately.

However, there is also another technique that the Location Services system can take advantage of: scanning for nearby Wifi access points.

IP addresses only reveal general location information



Suppose you are surfing the web on your laptop and a website asks you for location information. You give the website access and the interesting thing is that soon after, this website also has your location, with an acceptable error level.

But you also realize your laptop doesn't have built-in GPS, so how can that website determine your physical address so accurately?

No, the problem is not with your IP address. If you give a website access to your location while you're using a non-WiFi desktop (or a laptop with an Ethernet connection and WiFi turned off), you'll only see a general estimate about his position, with not very high accuracy. For example, it can accurately determine the city, province and country you live in, but getting accurate street-by-street information like through GPS is completely impossible.

How does WiFi reveal your location?

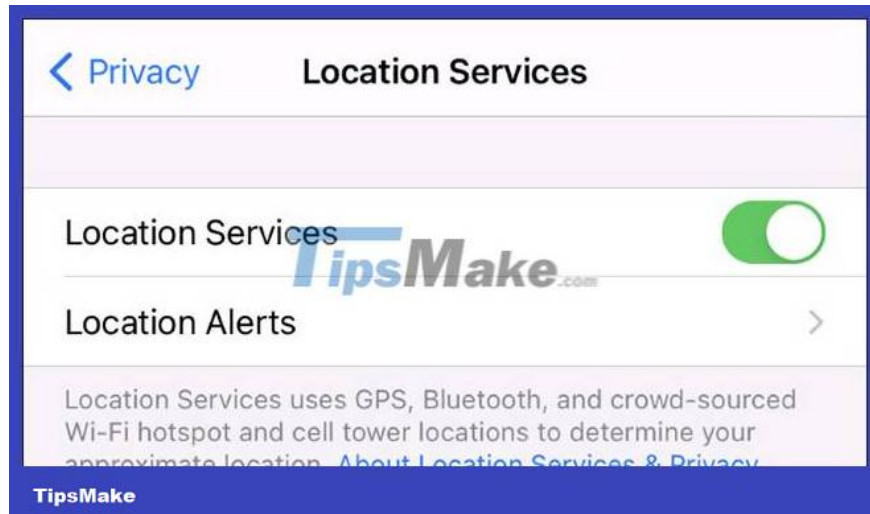
Here's how a "WiFi location system" works: Your device scans for nearby WiFi access points and generates a list of specific statistics, along with their relative signal strength at that location. your current position. It then contacts online servers. These servers. basically, contains a list of WiFi hotspots around the world and their geographical locations.

The database not only includes a list of WiFi access point names (SSIDs), but also contains the unique MAC addresses (BSSIDs) of those access points. These addresses usually don't change — even if the Wifi network's display name is changed.

By comparing the list of WiFi networks near you with the list of known access points and their locations, Location Services can guess your location. Additionally, by comparing the relative signal strengths of different WiFi networks, Location Services can also determine your location with extreme accuracy, as if you were using GPS.

Devices can also download and cache some of this data. For example, if the device knows you're in a particular town, it can download and store WiFi information in and around that town so it can find your location more easily, even when you don't have a network connection to compare with the database.

But where does the WiFi database come from?



More than a decade ago, Google began collecting data about WiFi networks using its Street View cars. While those cars go around corners and take pictures of storefronts, houses, and roads, they also scan for nearby WiFi networks and save relevant data for use with Location Services. .

Not only Google, Apple, Microsoft and other large technology companies also own their own Location Services systems.

Besides, the Location Services software built into your device has also been continuously sending information to keep these databases updated. For example, you open Google Maps on your Android phone. You have a strong GPS signal — great, your phone knows where you are via GPS. Your phone will now scan for nearby wireless networks and upload a list of them to Google's Location Services database, along with your current location.

Just like that, this database is continuously updated with more new data. Of course, companies always promise that this data is anonymous and not connected to any individual.

Privacy issue

In theory, the database only receives information about the list of neighboring networks, their unique identifiers, and their physical locations. It absolutely does not get any information about who is using these networks or what data is being transmitted over WiFi nor what passwords people need to connect to these networks.

At the same time, modern operating systems also prevent apps and websites from accessing this data unless you allow it. A website or app can't just see a list of nearby WiFi networks. It must request your browser or operating system to access your location, and you can of course decline this request if you wish. You are still in control.

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