Technical Paper

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Why Does it Take so Long to Get a GPS Fix?

It can sometimes take your GPS module 10-20 minutes to get a GPS fix. This Technical Paper will explain why.

Each satellite sends a message every 30 seconds. This message consists of two main components:

- **Ephemeris data** - to calculate the position of each satellite in orbit
- **Almanac** - which contains information about the time and status of the entire satellite constellation.

Only a small portion of the Almanac is included in a GPS message. It takes 25 messages (12.5 minutes) to get the full Almanac and the full Almanac is needed before a GPS fix can be obtained. This is referred to as 'Time To First Fix' (TTFF).

TTFF is a measure of the time required for a GPS receiver to acquire satellite signals and navigation data, and calculate a position solution (called a fix).

Cold Start

The above happens during a 'cold start', this is when the GPS module has been off for some time and has no data in its memory. A full Almanac download is required to get TTFF. If the GPS module has clear line of sight to all satellites, the shortest time for TTFF is 12.5 minutes.

Warm Start

In a 'warm start' scenario, the GPS module has valid Almanac data, is close to its last position (100km or so) and knows the time within about 20 seconds. This approximate information helps the receiver estimate the range to satellites. The TTFF for a warm start can be as short as 30 seconds, but is usually just a couple of minutes.

Hot Start

A receiver that has a current almanac, ephemeris data, time and position can have a 'hot start'. A hot start can take from 0.5 to 20 seconds for TTFF.

aGPS

Smarts phones use Assisted GPS (aGPS), this allows them to download the Ephemeris data and Almanac over the cellular network which greatly reduces the TTFF.