abeeway
Smart geolocation technology

Abeeway Trackers
Quick Start Guide

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1. ABOUT THE ABEEWAY TRACKERS

Thank you for purchasing the Abeeway Trackers.

Abeeway trackers are low-power multi-technology trackers that enable low-power tracking use cases.

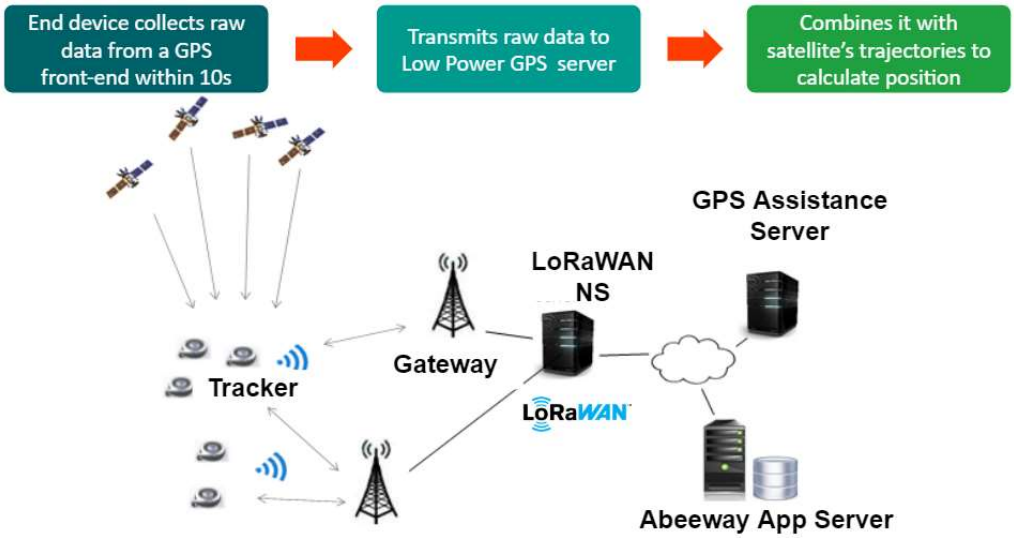
In the following sections, we describe briefly the overall architecture of the solution and different ways to setup the solution.

2. THINGPARK LOCATION OVERVIEW

ThingPark Location is a low-power multi-technology geolocation platform that allows tracking applications that demand very long battery lifetime. It enables wide variety of use cases that are not possible over conventional GSM+AGPS tracking technologies. The dramatic reduction in power consumption of tracker significantly increases the battery lifetime of 10 years+ due to reduction in Operating Expense/Total Cost of Ownership (OPEX/TCO) of enterprise deployments. For more details on the business case of Low-Power Wide Area Network (LPWAN) enabled geolocation, please refer to Actility/KPN webinar on multi-technology geolocation [1].

ThingPark Location leverages the appropriate combination of geolocation technologies (GPS, LP-GPS, Wi-Fi, BLE, LoRaWAN TDoA) depending on application preference or environmental conditions. One of the key technologies that enables low power is based on Abeeway's patented technology, Low-Power GPS (LP-GPS) that allows the calculation of location parameters partially in the cloud and thus significantly reduces the Time to first fix (TTFF) compared to traditional GPS based technologies. The key benefits of Low-Power GPS (LP-GPS) are:

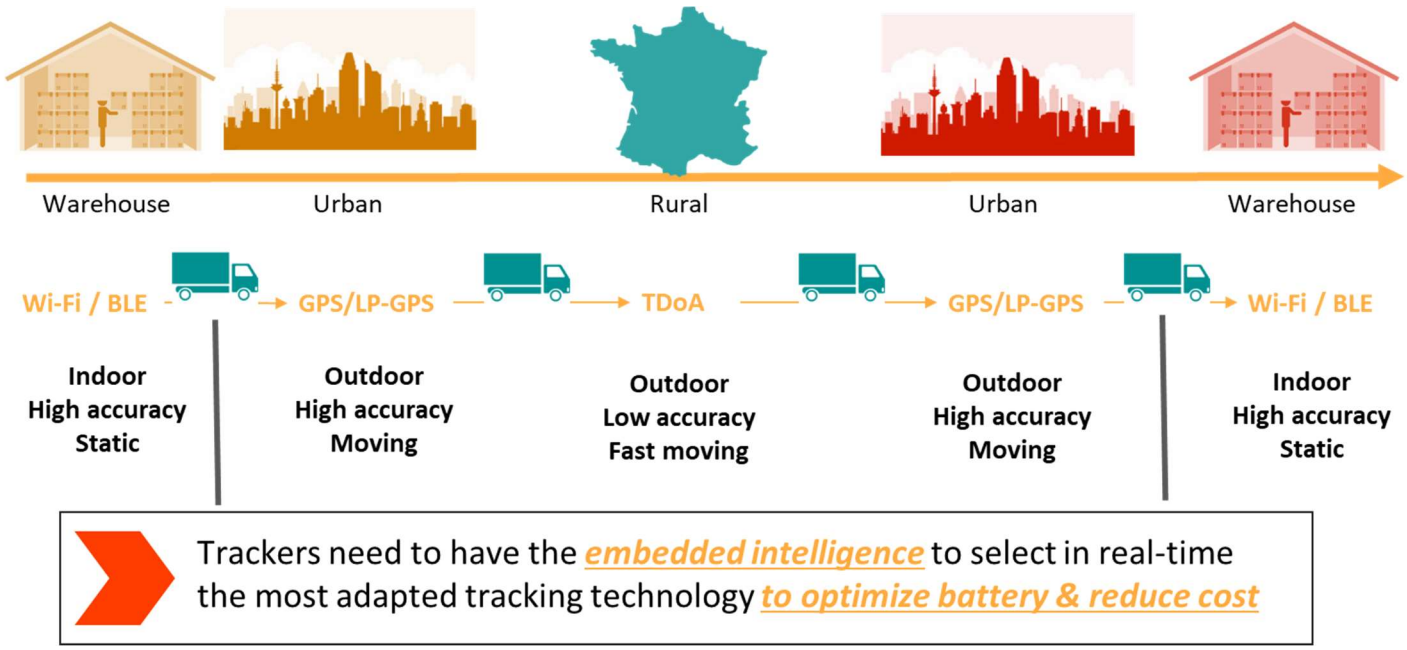
1. **High Speed**: First fix in 10s Vs 1 min compared to GPS
2. **Low Power**: 10X power efficient compared to GPS
3. **High Precision**: Able to acquire position even in poor GPS signal conditions



2.1 Optimum Geolocation: Multi-technology and Low-Power GPS (LP-GPS)

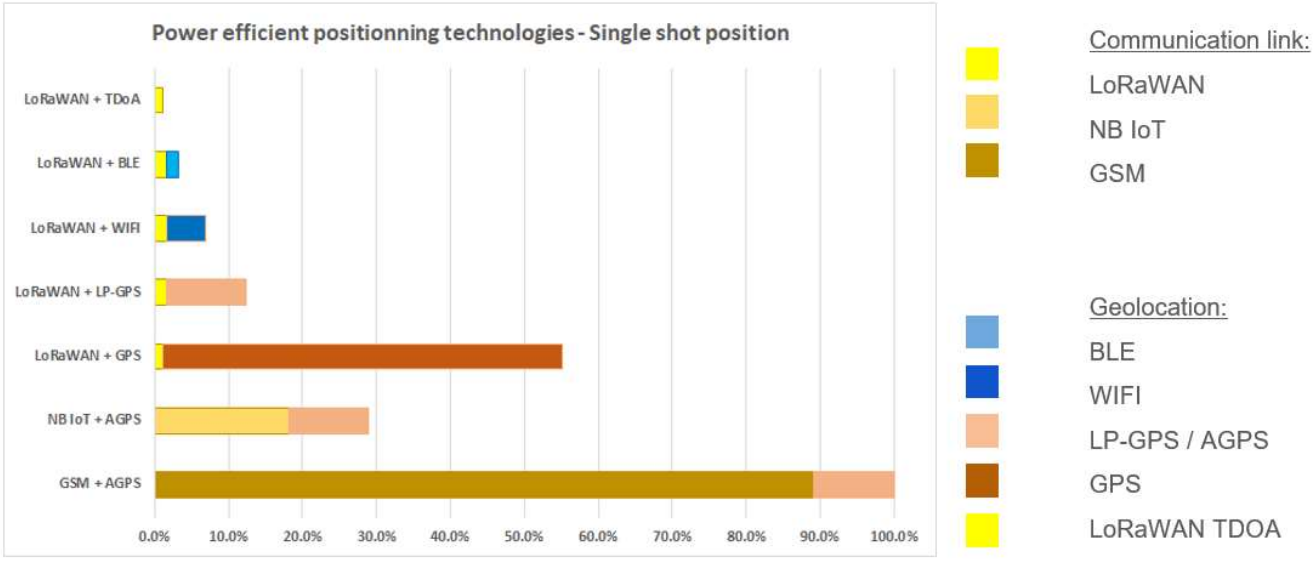
The figure below shows a generic example of a connected pallet travelling through different environments and requiring different geolocation technologies.

1. **Warehouse**: The connected pallet starts its journey indoors in the warehouse and needs high precision for geolocation. The tracker in this scenario is either static or moving slowly. The tracking technology suitable for such scenario is based on either Wi-Fi/BLE technologies using simple scanning-based on RSSI or relying on fingerprinting more accurate tracking [8][9].
2. **Urban**: Once the connected pallet leaves the warehouse, it is outdoors usually within urban area. In this scenario, the connected pallet is moving in a cargo and requires high accuracy. The most suitable tracking technology for such scenario is based on GPS/LP-GPS.
3. **Rural**: The connected pallet then travels through countryside and is travelling generally at high speeds on motorway. The tracking accuracy is less important, and the tracker will save power by automatically going into frequent sleep mode and using the most suitable technology to save power consumption: TDOA, instead of GPS. This requires the availability of a wide area deployment of LoRaWAN.



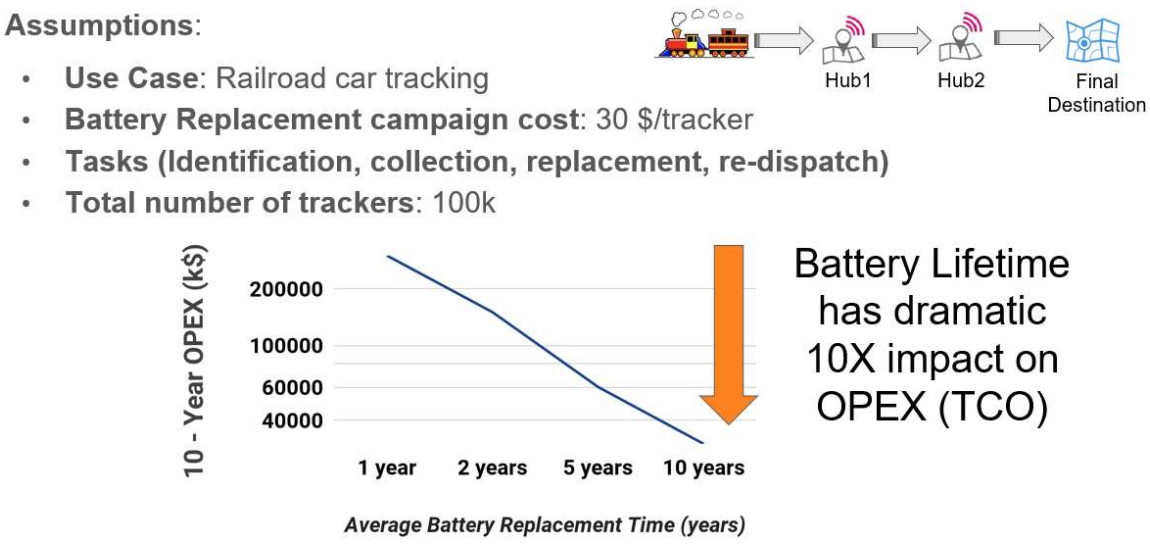
For IoT geolocation use cases, wanting to optimize battery life 10 years and more, multi-technologies are required, that includes Low-Power-GPS. The location information is transported over LoRaWAN, which is 3-5X more power efficient LPWAN technology compared to 3GPP based technologies (NB-IoT/LTE-M) [10][11].

The following figure shows the comparison of different geolocation technologies (TDoA, WiFi, BLE, GPS, AGPS, LP-GPS) over different communication technologies such as GSM, LoRaWAN, NB-IoT, LTE-M. The power consumption comparison in the figure below assumes that the tracker sends only one location. It is very clear from the figure below that LoRaWAN+LP-GPS based tracker is around 10X more power efficient than traditional GPS+AGPS based technologies. The power consumption of the tracker can be further reduced when using Wi-Fi/BLE for indoors or when using LoRaWAN based network geolocation such as TDoA. For more information on the study, see [1].



LoRaWAN + Multimode Geolocation is 10X battery efficient compared to conventional Geolocation (GSM + AGPS)

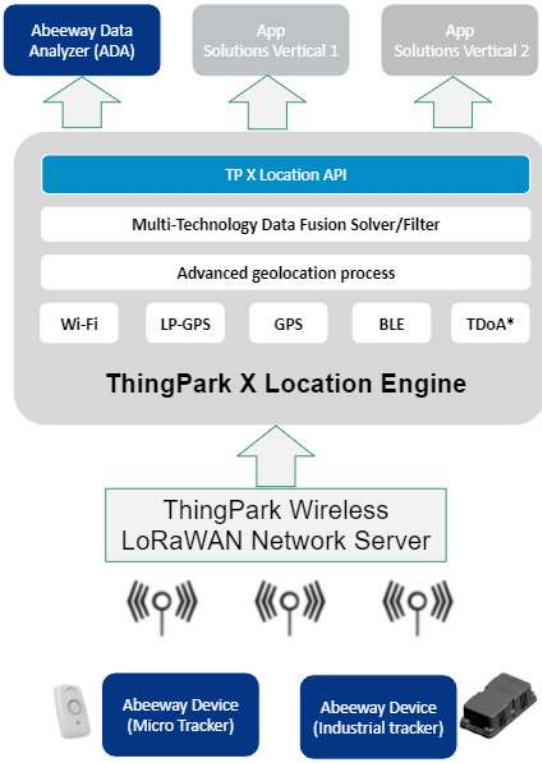
The dramatic reduction in power consumption of the tracker enables IoT geolocation use cases not possible with conventional GPS+AGPS based technologies. The figure in the following example is Total Cost of Ownership (TCO) analysis based on the example of railroad car tracking. Railroad cars carrying heavy equipment usually travel through countryside, thus it is important to track their location and usage to improve the efficiency and optimize the freight capacity. Railroad cars also need to be tracked in case they are lost in remote areas. Replacing the trackers in railroad cars is a very cumbersome exercise that involves activities such as (identification, collection, replacement and re-dispatch). This activity is even more costly if the trackers are placed in hard to reach areas in the wagon. Typically, the battery replacement campaign is carried over large number of railroad cars. In the following example, we assumed the cost of replacing battery to be about 30 USD/tracker which is a rather conservative estimate considering the human labor cost of such replacement. Assuming there are about 100k rail road cars that each have a tracker that needs battery replacement. The following figure shows that the OPEX savings of up to 10X when the tracker needs battery replacement every 10 years Vs 1 year. The simple example below shows clearly that over long durations of IoT deployments (typically 10 years or more), the battery replacement costs have a very dramatic impact on OPEX and could possibly dominate the TCO.



2.2 Architecture

The ThingPark Location architecture is shown in the figure below and has three basic components:

1. **Abeeway Devices**: These are low power devices capable of multi-technology geolocation capabilities.
2. **ThingPark X Location Engine**: This is the back-end geolocation engine that contains multi-technology geolocation solver that relies on Wi-Fi, BLE, GPS, LP-GPS and TDoA. This component also provides DX Location API that can be used to interface with enterprise B2B applications. ThingPark X Location Engine is usually interfaced with LoRaWAN Network server which can be ThingPark Wireless or 3rd Party.
3. **Abeeway Device Analyzer (ADA)**: This is an example application that allows to view the device locations on a map and configure the different geolocation modes of the Abeeway devices.



2.3 Abeeway Devices

There are two types of tracking devices in the Abeeway product portfolio. The sections below describe high-level features and provides an overview. A detailed description of Abeeway device features and specifications are described in reference documents [2-7].

2.3.1 Abeeway Micro Tracker

The Abeeway Micro Tracker is a multi-mode tracker combining GPS, low power GPS (LP-GPS), Wi-Fi, LoRaWAN™ and BLE radios with embedded sensors to support accurate outdoor and indoor geolocation. This low-power location device tracks and locates anything, anyone, anytime at a low cost of ownership. Its small size and long battery lifetime make the Micro tracker the ideal product for numerous tracking applications. It is simple to use, and a single button gives access to numerous functionalities that can be personalized for specific application needs. It can be used to keep track of assets, valuables, improve safety and security.

Applications of Micro-tracker:

- Asset tracking at fixed frequency updates or on demand
- Personal tracking with help button
- Safety monitoring for lone workers inside facilities or in outdoor
- Anti-theft; notify and locate when device is moving
- Geofencing applications

2.3.2 Abeeway Industrial Tracker

The Abeeway Industrial Tracker is the most versatile device to protect your assets designed to withstand harsh environment. It combines high performance GPS, LP-GPS and Wi-Fi receivers as well as Semtech LoRa™ transceiver making it ideal for low-power industrial indoor and outdoor tracking applications. The Abeeway Industrial Tracker tracks your inventory, valuables, livestock and is key for improving operational efficiency. It delivers valuable information about your supply chain and provides precise and accurate data to help making informed decisions. An accelerometer detector associated with proprietary low power GPS (LP-GPS) technology significantly extends the battery life time, dramatically reducing the total cost of ownership.

Applications of Industrial Tracker

- Asset and vehicle tracking at fixed frequency updates or on demand
- Anti-theft; notify and locate when the device is moving
- Activity monitoring
- Geofencing applications

2.3.3 Key Product Features

Multiple operating modes:

- **Motion Tracking:** Tracker reports real-time position only when motion is detected
- **Permanent tracking:** Tracker reports periodic real time positions
- **Start/End motion tracking:** Tracker reports positions ***only*** at the start and end events of the motion
- **Position on demand:** Tracker sends its position only when requested from the end-user (very low power operating mode). The position request can be made from the geolocation backend platform or by using special button sequence on the micro-tracker.
- **Activity tracking:** Monitor activity rate with embedded sensors
- **OFF**: Tracker is switched off

Geolocation technologies:

- **GPS:** Precise outdoor position
- **Low power GPS (LP-GPS):** Proprietary Low-Power GPS algorithm that enables Fast Time to First Fix in outdoor and daylight indoor conditions resulting in improved battery lifetime
- **Wi-Fi:** Position in indoor and urban area
- **BLE:** The micro-tracker has Bluetooth scanning capabilities which can send BLE beacons and their detected RSSIs to the application

Other features

- User interface: Buzzer, LEDs, Multi-modes button (This feature is only supported for Micro-Tracker)
- Temperature monitoring
- Embedded antennas
- LoRaWAN™ Class A radio
- Water-spray resistant enclosure (IP64) (Only relevant for micro tracker)
- Rugged industrial enclosure for protection from dust and powerful water jets - (IP66) (Only relevant from industrial tracker)

3. SETTING UP THE TRACKER

Abeeway trackers require LoRaWAN connectivity. There are three ways to use Abeeway trackers.

1. **Abeeway Decoder:** This method can be used for any LoRaWAN network and can be used to decode the payload of the tracker. The payload decoder is docker based and the instructions to use it are present in the "Abeeway Firmware Decoder" which is inside the "Download" section of Click&Go Low Power Trial package here, https://iot.thingpark.com/clickandgo/location-asset-tracking/1861-lp-location-solution-ufispace-eu868.html

2. **Click&Go Network Extension Pack (Recommended):** This method includes a LoRaWAN Gateway, ThingPark Wireless, ThingPark Location Engine subscription. ThingPark Location Engine subscription includes DX Location API and Abeeway Device Analyzer (ADA) which is a very useful tool to visualize the trackers on the map and configure the tracker parameters. ThingPark Location Engine also significantly improves the accuracy and power consumption of the trackers due to post processing of location data on the backend. It is recommended to

purchase Macro Gateway package for improved coverage to conduct outdoor trials. For more information on Click&Go network extension packages, https://iot.thingpark.com/clickandgo/397-radio-gateway

3. **Click&Go Low Power Trial Package (Recommended):** This method includes a LoRaWAN Gateway, ThingPark Wireless, ThingPark Location Engine subscription and trackers. ThingPark Location Engine subscription includes DX Location API and Abeeway Device Analyzer (ADA) which is a very useful tool to visualize the trackers on the map and configure the tracker parameters. ThingPark Location Engine also significantly improves the accuracy and power consumption of the trackers due to post processing of location data on the backend. For more information on Click&Go location packages, https://iot.thingpark.com/clickandgo/442-location-asset-tracking

4. REFERENCES

[1] Actility/KPN Webinar on Multi-technology Geolocation: Slides, Recording.

[2] Abeeway Micro Tracker Firmware Reference Guide

[3] Abeeway Industrial Tracker Firmware Reference Guide

[4] Abeeway Micro Tracker Product Brief

[5] Abeeway Industrial Tracker Product Brief

[6] Abeeway Micro Tracker Data Sheet

[7] Abeeway Industrial Tracker Data Sheet

[8] WiFi Positioning Technologies Overview: https://en.wikipedia.org/wiki/Wi-Fi_positioning_system

[9] Indoor Positioning Technologies Overview: https://en.wikipedia.org/wiki/Indoor_positioning_system

[10] Actility/Orange Webinar on how does LoRaWAN and Mobile IoT Complement each other. Slides, Recording

[11] Actility Whitepaper: LoraWAN and Cellular IoT (NB-IoT, LTE-M): How do they complement each other?. Link