

BLUEGPS · UPDATED MAY 19, 2026

BlueGPS Tracking Technologies Overview

Comparative overview of tracking technologies supported by the BlueGPS platform, including advantages, disadvantages, and use cases.

ON THIS PAGE

Overview

.....

1. Angle of Arrival (AoA)

.....

Architecture

.....

Advantages

.....

Challenges

.....

Use Cases

.....

2. Bluetooth Mesh + RSSI-Based Localization (RSSI + BLE MESH)

.....

Architecture

.....

Advantages

.....

Challenges

.....

Use Cases

.....

3. Bluetooth Unmanaged + RSSI-Based Localization (RSSI + BLE Unmanaged)

.....

Architecture

.....

Advantages

.....

Challenges

.....

Use Cases

.....

4. Comparison Summary

.....

5. Conclusion

.....

Overview

BlueGPS platform is designed to integrate any tracking technology and includes a large set of already supported technologies.

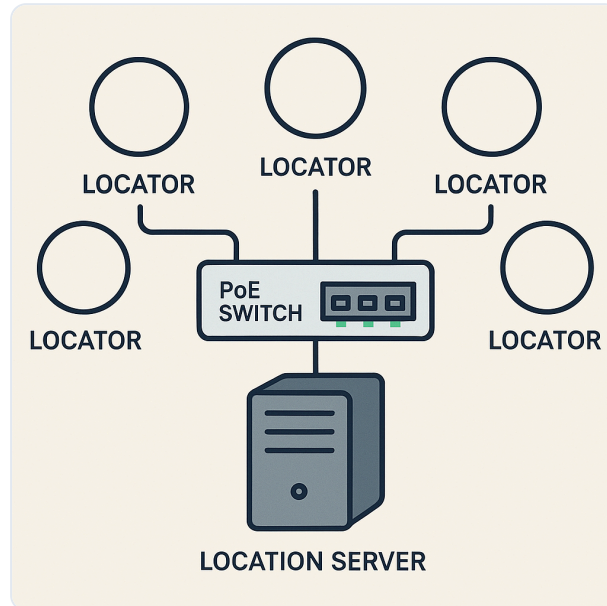
This document provides a comparative overview of tracking technology supported by BlueGPS platform. The document provides a list of advantages and disadvantages on using one or another technology.

The technology analysed in this document has different characteristics that can cover multiple use cases. Because BlueGPS can easily manage different technologies in a uniform interface, the Synapses' team can suggest the right technology to fulfill the customer's needs relative to use case and budget.

1. Angle of Arrival (AoA)

Principle: AoA determines the direction of a Bluetooth signal by analyzing the phase difference between multiple antennas in an array. The angle is calculated using complex signal processing algorithms.

Architecture



System Element

- **Locator:** Antenna with receiver array able to detect the angle of a BLE signal with precision that can be 0.1° or 1°, according to the accuracy needed and the locator placements.
- **POE switch:** Each locator has to be connected to the network. The Ethernet cable can be the locator's power supply, so a POE switch is usually the standard option.
- **Location Server:** An edge computation device.

Tracked devices

- **Tags:** The system is able to track tags that send a specific BLE signal able to be detected by the locator. The channel can also be used to transport other information, like tag temperature or other data if the tags are able to collect it.
- **Smartphone:** A smartphone equipped with BlueGPS SDK can act as a tag and be tracked by a location system. In this case, the SDK sends a BLE signal that requires low power due to the low-energy nature of BLE.

Advantages

- **High accuracy:** Can reach sub-meter precision.
- **Real-time tracking:** Suitable for dynamic environments like asset tracking or people flow.
- **Directional information:** Adds value in scenarios where orientation matters.

Challenges

- **High infrastructure costs:** specific hardware is required, and this hardware must be physically connected through dedicated network cables.
- **Calibration complexity:** Requires careful antenna alignment and environmental tuning.
- **Deployment density:** Needs multiple locators for robust coverage.

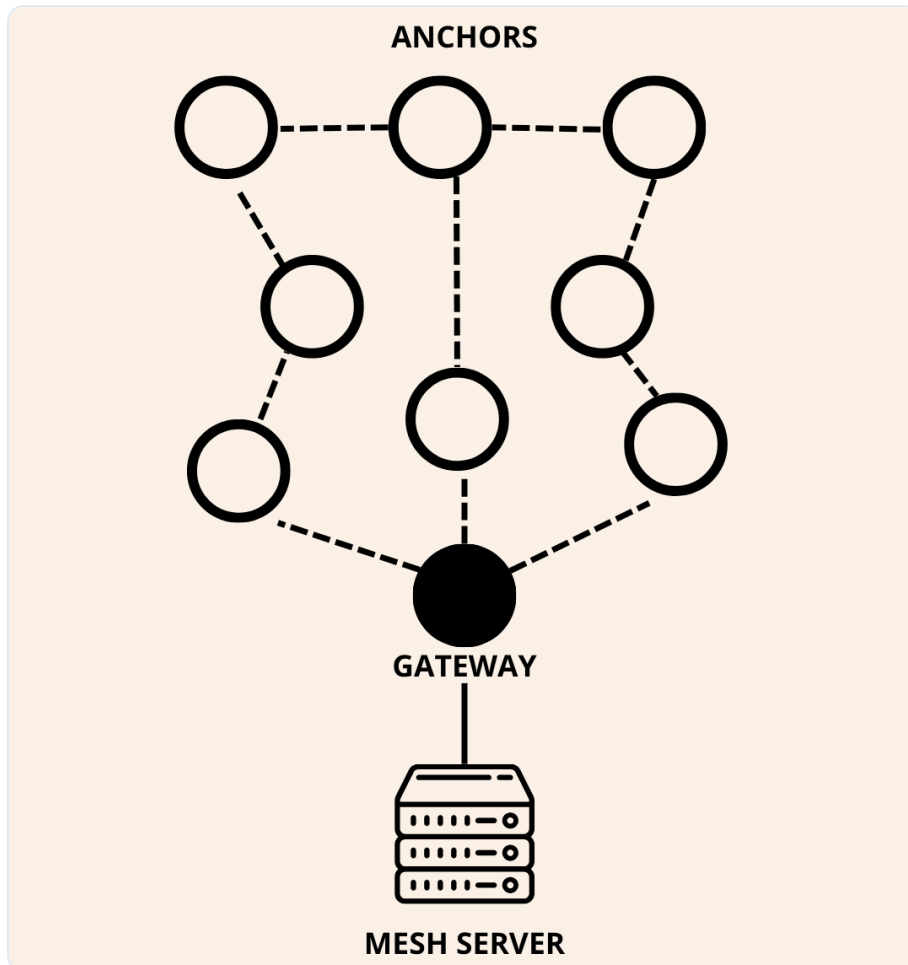
Use Cases

- Industrial asset tracking.
- Indoor navigation in complex environments.
- Real-time location systems (RTLS) in logistics and healthcare.

2. Bluetooth Mesh + RSSI-Based Localization (RSSI + BLE MESH)

Principle: Utilizes the signal strength (RSSI) of Bluetooth messages received across a mesh network to estimate the position of a device.

Architecture



- **Anchor:** BLE device that acts as a Mesh node. This node can be battery-equipped or with an external power supply.
- **Gateway:** BLE device that acts as a Mesh node. This node is connected to the network to reach the Mesh Server.
- **Mesh Server:** A server able to monitor the network status and the position of the anchor or device.

Tracked devices

- **Tags:** The tag sends a signal, and the triangulation is based on RSSI. To reduce battery consumption, this indication is sent with a low frequency.
- **Smartphone:** A smartphone equipped with BlueGPS SDK can act as a tag and be tracked by a location system. The smartphone performs all the position computation, allowing a better position estimation at the cost of higher power consumption.

Advantages

- **Low-cost infrastructure:** Uses standard Bluetooth mesh devices.
- **Scalable and robust:** Mesh topology increases reliability and coverage.
- **Easier deployment:** No need for antenna arrays.

Challenges

- **Lower accuracy:** Typically in the range of 2-5 meters.
- **RSSI variability:** Signal strength fluctuates due to obstacles and reflections.
- **Environment-sensitive:** Accuracy depends on layout and materials.

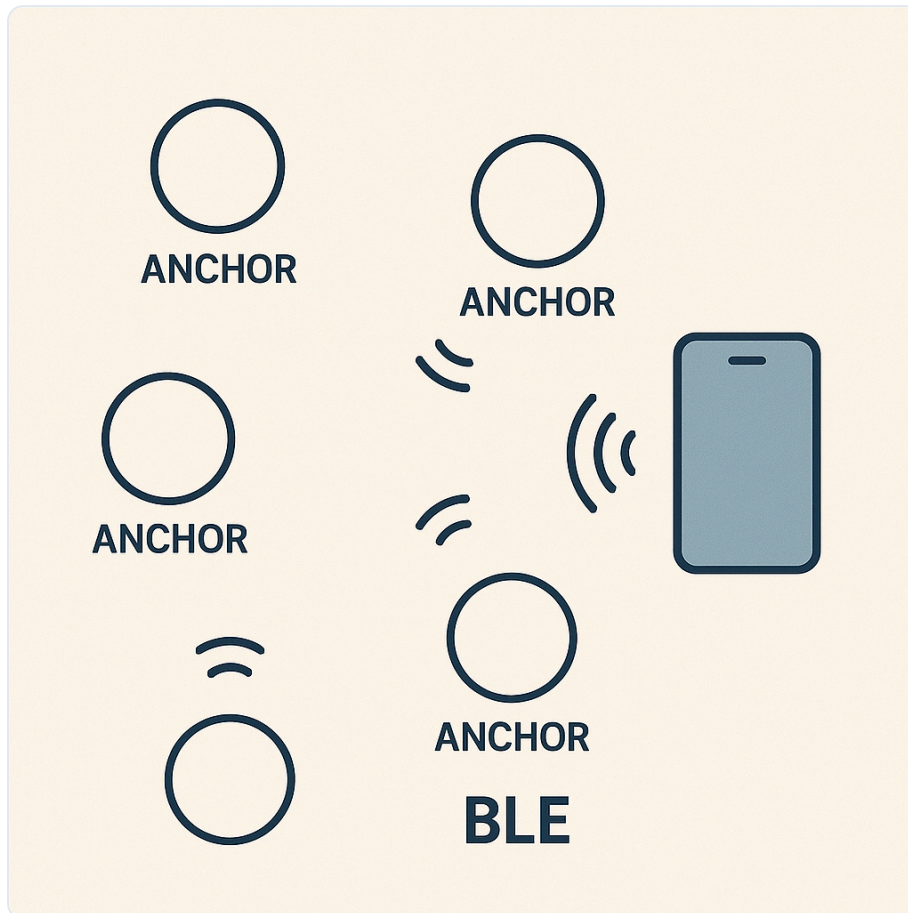
Use Cases

- Smart building automation (e.g., lighting, HVAC based on presence).
- Coarse-grained asset tracking.
- Occupancy analytics.

3. Bluetooth Unmanaged + RSSI-Based Localization (RSSI + BLE Unmanaged)

Principle: Utilizes the signal strength (RSSI) of Bluetooth to localize the smartphone device.

Architecture



- **BLE advertising device:** This device can be battery-equipped or have an external power supply.

Tracked devices

- **Smartphone:** A smartphone equipped with BlueGPS SDK can act as a tag and be tracked by a location system. The smartphone performs all the position computation, allowing a better position estimation at the cost of higher power consumption.

Advantages

- **Lower-cost infrastructure:** Uses standard Bluetooth devices.
- **Easier deployment:** No need for antenna arrays.

Challenges

- **Lower accuracy:** Typically in the range of 2-5 meters.
- **No monitoring:** The device must be checked periodically.
- **RSSI variability:** Signal strength fluctuates due to obstacles and reflections.
- **Environment-sensitive:** Accuracy depends on layout and materials.

Use Cases

- Smart building automation (e.g., lighting, HVAC based on presence).
- Coarse-grained asset tracking.
- Occupancy analytics.

4. Comparison Summary

Feature	AoA	RSSI + BLE Mesh	RSSI + BLE Unmanaged
Accuracy	High (sub-meter)	Medium (2-5 meters)	Medium (2-5 meters)
Hardware Requirements	Specialized locators, Location server	Standard Bluetooth Mesh nodes, Monitoring Server	BLE nodes
Cost	High — Infrastructure; License for Location server	Medium — License for Mesh Server; License for complex SDK on Mobile	Low — License for complex SDK on Mobile
Deployment Complexity	High (calibration needed)	Medium	Easy
Scalability	Medium	High	High
Real-time Capability	Strong	Moderate	Moderate
Monitoring	Real Time (~1 second)	Near Real Time (~5 minutes)	Manual
Tracked devices	TAG, SMARTPHONE	TAG, SMARTPHONE	SMARTPHONE
Battery consumption on a smartphone	LOW	HIGH	HIGH

5. Conclusion

AoA is the preferred choice for applications requiring high-precision and real-time location tracking, albeit at a higher cost and complexity. RSSI-based Bluetooth Mesh localization offers a more cost-effective and scalable solution for scenarios where coarse location data suffices, by adding monitoring at the simple BLE solution. Using BLE anchors enables only Smartphone tracking and can be an effective solution in a non-critical environment.