The Marketer's Guide to Bluetooth® LE Indoor Location Services

CREATING AMAZING ONSITE MOBILE EXPERIENCES WITH VIRTUAL BEACONS

Mist

A.I. is in the AIR™

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Location-based mobile marketing is a boon to every marketer tasked with delivering the right message to the right person at the right time. After all, there's no better time to reach prospective customers than when they are nearby. And there's no better way to provide personalized, targeted information than by combining what you already know about them with their current location inside your establishment.

Most people are aware of the Global Positioning System (GPS), which is the defacto standard for location-based interaction when outdoors. It uses geofencing technology to trigger activities, such as push notifications, when a mobile device enters or leaves a virtual geographic boundary. However, GPS does not work when it comes to indoor location services. That is why a new technology, Bluetooth® Low Energy (BLE), has emerged to identify and engage with mobile employees, customers, and guests inside hotels, stores, convention centers, hospitals, and other establishments.

If you're reading this guide, chances are you've heard about Bluetooth® LE. Perhaps you've experimented with battery-powered BLE beacons, but struggled with the complexity of creating a complete solution from the disparate parts of different vendors. Maybe you ran a successful pilot, but when it came time to scale, your IT department said it would be too complicated and costly to manage.

If so, you're not alone. While indoor location using Bluetooth® LE has been around since Apple's introduction of the iBeacon protocol in 2013, challenges with scalability, interoperability, and manageability have hampered large-scale adoption of this technology to date. Fortunately, this is all changing.

New advancements in the wireless infrastructure, such as virtual beacons enabled by machine learning, have made Bluetooth®LE easy to deploy and operate at scale. In addition, the convergence of Wi-Fi and BLE has removed the need for an overlay network, making it more cost effective than ever to roll out indoor location services.

We are in a new era of enterprise-grade, personalized, indoor-location services using BLE. Are you ready to take advantage of it? This paper will show you how.

What you'll learn:
- Bluetooth® LE basics and common beaconing standards
- Top use cases for BLE (e.g. analytics, wayfinding, proximity messaging and more)
- Overcoming BLE deployment and management challenges
- The Mist solution for BLE engagement
- Getting started

THE ABCS OF BLUETOOTH® LE

Bluetooth® is the ubiquitous communications technology we all use to connect our wireless headsets, keyboards, and hands-free systems to our smart phones and computers. Operating in the 2.4GHz band (the same as Wi-Fi), Bluetooth was designed for continuous streaming of voice and data over short distances, and comes standard in all modern mobile devices.

Bluetooth® Low Energy (BLE) is a subset of the Bluetooth protocol introduced in 2011. Unlike classic Bluetooth's continuous streaming, BLE was designed for transmitting short bursts of data. Because it stays in sleep mode until a connection is initiated, BLE consumes far less energy than

I see 2 Beacons

Here I am!   Here I am!

BLE Tag   Access Point   Mobile Device

classic Bluetooth. This energy efficiency is driving a new class of wireless devices and applications, from smart home sensors and wearables like Fitbits, to indoor-location beacons and proximity marketing.

Beacons are devices that use Bluetooth® LE to transmit short packets that are used for providing location-based information, such as proximity notifications, location, and nearby items of interest. They can be used for anything from analyzing customer traffic patterns to providing turn-by-turn directions and delivering offers or other contextual information based on physical location. You can even turn your mobile phone into a BLE beacon for use cases such as letting the server in a restaurant know you would like another drink.

There are two main protocols used for Bluetooth® LE beaconing: iBeacon, introduced by Apple in 2013, and Eddystone, Google's cross platform beaconing protocol that was launched in 2015. Both protocols work in a similar fashion by broadcasting a unique identifier that is picked up by a compatible app or operating system on the phone or other mobile devices, to determine its relative position at your location. (A third protocol, Altbeacon, was announced in July 2014 as an open source beacon protocol. It overcomes vendor tie-in, but lacks the widespread adoption of iBeacon and Eddystone.)

It is worth pointing out that Bluetooth® LE beacons are an opt-in solution. Mobile consumers grant permission to use their location information in exchange for content or services they consider valuable. Mobile devices must have Bluetooth® and location services on, and either a mobile app configured for BLE, or Google Chrome installed (if you're beacon is configured with Eddystone-URL).

BLUETOOTH® LE BEACON USE CASES ARE LIMITED ONLY BY YOUR IMAGINATION

The more you integrate a mobile user' location data with everything else you know about the user, the more personalized, valuable, and amazing the experience. With Bluetooth® LE (BLE) now standard in all modern mobile devices (and expected to be in 90% of all devices by 2018), and more people enabling Bluetooth (required to pick up beacon signals) to communicate with their wireless peripherals, BLE beaconing is quickly moving from a nice-to-have to a must-have marketing technology in 2017.

> *53% of retailers plan to identify customers as they walk through their doors via smartphone by 2020*
> *-- Boston Retail Partners survey*
>
> *80% of millennials use their mobile phones in-store. 74% are willing to receive location-based mobile alerts*
> *-- Data & Marketing Association (DMA) 2017 Statistical Fact Book*

Companies of all sizes are using BLE technology to gain tremendous insight into employee, customer, and guest behavior, and to offer helpful, convenient, and incredibly personalized new services. Here are just some of the use cases that are enabled with BLE indoor location services:
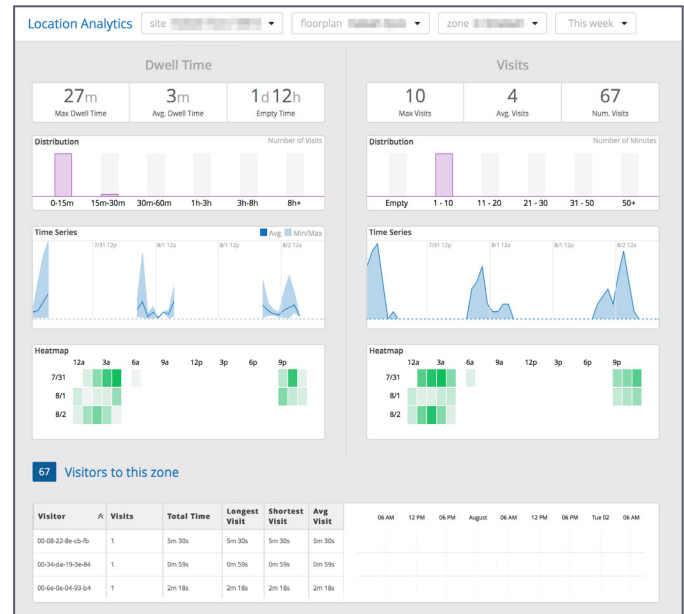
Analytics – Gather zone-based user analytics, such as the average number of people in your establishment, the number of passersby, or the length of time each person spends at a particular display, area or department. Look at traffic patterns by time of day, day of week, or by season. Integrate with other data such as weather feeds and customer relationship management (CRM) to gain even greater insights.

Wayfinding (Indoor Navigation) – A GPS-like navigation experience for indoor environments. Wayfinding typically offers turn-by-turn directions and a map showing the user moving toward his or her destination. Ideal for airports, hotels, casinos, tradeshows, events, malls, or any other large venue.

TRADITIONAL BLUETOOTH® LE DEPLOYMENT AND MANAGEMENT CHALLENGES

While the use cases for Bluetooth® LE are compelling, historically it has been a challenge to deploy and operate large BLE networks in a cost-effective way. That is because the beaconing technology to date has required battery powered devices (i.e. transmitters), which create the following challenges:

- Comprehensive site surveys are required to arrange and calibrate beacons for optimum performance and accuracy in a given environment. Want to move or add more beacons? Another site survey and recalibration is required. Because RF signals can be impacted by physical changes in the environment—such as new product displays, moved furniture, or even large influxes of people—the system will be plagued by poor performance until the beacons can be recalibrated. What retail store or event venue doesn't change on a regular basis? Who has an IT staff capable of dealing with dynamic daily changes, like large groups of people, on demand?

- High deployment costs. Many of the use cases above require a location system with granular micro-location to deliver one to three meter accuracy. This would requires thousands of beacons in a single location, which creates substantial cost barriers.

- Battery maintenance is problematic- While battery life has improved, a large enterprise may deploy tens of thousands of beacons, distributed across the globe. Locating and replacing dead batteries can be a weekly occurrence. The more you beacon to get accurate and timely location information, the faster you'll be replacing batteries.

- Lack of enterprise-grade management means costly truck rolls and time-consuming manual processes. Physical beacons lack IP addresses. As such, they can't be identified by the network and be managed remotely by IT.

I'm a battery-powered Beacon

- Aesthetics. Battery powered beacons are glued to the wall, often 25 feet apart. This can adversely impact the appearance of a location, which is often a nonstarter in hotels, museums, and other locations where aesthetics is important.

- Risk of theft. Battery powered beacons can be stolen or knocked off the wall, creating additional management headaches.

All told, a large enterprise can expect to pay approximately $300 per beacon in maintenance costs. Even if your use cases warranted the high cost, there is still the issue of inconsistent user experiences to consider. Differences in mobile device types (chipsets, OS, antenna, etc.), and dynamic changes to the RF environment—like that large influx of people-- can dramatically affect accuracy and user experience. Manual site surveys and RF calibrations simply cannot keep up.

MIST VIRTUALIZES INDOOR LOCATION

For indoor location services to truly take off, companies require BLE deployments that integrate with their existing networks, scale to handle millions of mobile devices, and automatically recalibrate for different device types and dynamic changes to the environment in real time.

Fortunately, new solutions like the Mist Learning WLAN integrate BLE with Wi-Fi in a single A.I.-driven platform that is operated via the cloud.

Mist APs Have Directional BLE Antenna Array
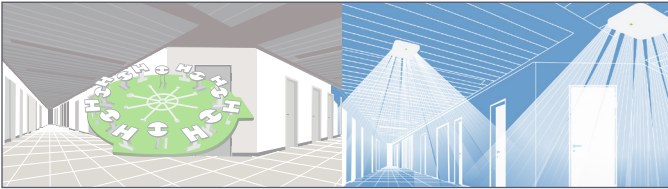
Unlike other WLANs that just integrate a single BLE beacon in an Access Point and/or make it possible to monitor battery beacons via a centralized management tool, Mist completely virtualizes the indoor location experience for maximum scale, performance, ease of use, and cost effectiveness. Here are the unique components of the Mist solution:

Access Points with directional BLE antenna array. The first step in a Bluetooth® LE location service is to blanket the room with BLE signals. Rather than use physical beacons, Mist achieves this with a patented 16 element directional antenna array in Mist Access Points, which sends unique RF energy in multiple different directions. With BLE signals emanating from the AP, Mist eliminates the need for battery powered BLE beacons and lets mobile devices interact with an entire room instead of a single transmitter.

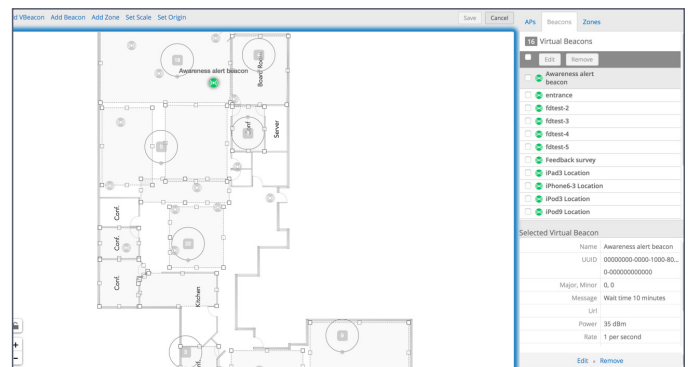### Machine Learning in the Cloud

Machine learning in the cloud. An iPhone 6s operates very differently than an iPhone 5s or Samsung Galaxy on a wireless network. But knowing that doesn't make it any easier to recalibrate for every situation. To address this, the Mist platform uses artificial intelligence to account for differences in devices, as well as constant changes to the RF environment—such as moving a chair, or adding a partition. It continuously takes location estimates from every-day use, examines them, detects the RF characteristics based on the actual input, and adapts the location formula to maximize accuracy.

Machine learning operates across different end user device types, constructing specifically tailored path loss formulas. This is naturally necessary as different devices have different RF characteristics. By continuously and automatically adapting to different devices and changing RF environments, new Mist WLAN systems obviate the need for manual calibration in BLE environments.

Patented Virtual Beacons

Virtual Beacons. As mentioned above, Mist eliminates the need for battery powered beacons by moving the Bluetooth® LE beaconing functionality into the AP and using machine learning in the cloud. To enable location-specific messages, Mist patented a new concept known as virtual beacons. Virtual beacons use geofencing technology to allow specific messages to be displayed anywhere on a floor plan (like GPS uses outdoors). The message, range and location is completely configurable using software – i.e. the Mist UI or APIs. With Mist, an unlimited number of virtual beacons can be deployed in any physical environment, providing unsurpassed scalability and ease of use.

The above technologies enable Mist to deliver 1-3m location accuracy with sub-second latency, making it ideal for all the use cases mentioned above. By integrating this functionality into an enterprise-grade WLAN platform, you save time and money on deployment and operations while ensuring maximum scalability and reliability.

HOW TO START YOUR OWN INDOOR LOCATION JOURNEY

Now that you understand the basics of Bluetooth® LE and how to deploy a scalable solution, here is what you need to get started with indoor location services:

A Bluetooth® LE-enabled mobile app

A mobile app with a compelling user experience is essential for a successful proof of concept. You can start with a simple navigation or wayfinding app, or any number of readily available third-party apps designed specifically for your industry. If you have your own branded app, your beacon platform provider can supply your developers with the software developer kit (SDK) they'll need to BLE-enable your app. You can also find expert BLE app development partners to help you customize your app or build one from the ground up.

Indoor Map

A digital map of your facility or campus is required for navigation and proximity marketing. Your POC use case will help you determine how extensive your initial indoor map needs to be. But you should also consider what will be required and who will maintain your maps long term. Indoor mapping and navigation vendors catering to a variety of industries can be found in the Mist BLE Alliance.

Bluetooth® LE beacon infrastructure and analytics

Beacons and accompanying software services are required for blue dot location and analytics. A few battery beacons are all you need to test pilot your application. However, we recommend you engage early with your IT department, and an enterprise-grade BLE/Wi-Fi provider to ensure your solution can scale.

Mist Case Study

BRICKELL CITY CENTRE

Retailers Gain Valuable Insight and Engage Customers with Mist

Who: Brickell City Centre (4.9 million sq ft in South Florida)

Results with Mist:
- Understand customer behavior and traffic patterns, such as the number of visitors to a specific area, average dwell times, and time of day analysis.
- Create an amazing shopping experience for consumers and retailers using wayfinding, proximity notifications, and virtual concierge services.
- Cover the entire property with Wi-Fi, eliminating the need for customers to switch to in-store networks while roaming.

"The Mist wireless platform is the backbone of Brickell City Centre. It gives us the data that says what our customer base is doing onsite, which is correlated with other channels so we can maximize the shopping experience."

Management platform

Most battery beacons are managed with a mobile app. When moving from POC to full-scale deployment, you may want to consider an enterprise-grade management system with machine learning and virtual beacon capabilities to avoid expensive overlay network management and unsatisfactory user experiences.

YOUR CEO WILL THANK YOU

The wireless world is at a tipping point where every smartphone, tablet and laptop has BLE, making these devices ready for new indoor location-based services.

Thanks to new modern wireless platforms with enterprise-grade BLE access points, machine learning in the cloud, and virtual beacon technology, the infrastructure is now ready to support the demand.

The use cases for BLE are endless. Are you ready to take advantage of the enormous opportunity? Mist can help you with all the elements needed to deliver a great BLE user experience. Email info@mist.com and we will get you started.