

# iBeacons

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- Marketing
- Technology
- Usability and User Experience
- Security and Privacy
- Case Studies
- Conclusion

Welcome to this presentation about iBeacons. I'm thrilled to have you all here tonight, thanks for coming; the response to this talk has been phenomenal and I couldn't be happier to welcome you to this event.

There will be a question and answer session at the end, so please make sure that your smartphones are set to "not disturb" or "airplane mode" and please wait until the end of the presentation to ask any questions you may have.

## **Introduction**

I'd like to start this presentation by showing you a short movie. Because, I think it's nice to start a talk by telling a story.

Who remembers this film? Of course, it is "Minority Report," a movie by Steven Spielberg from 2002. And a rather prescient movie, that is, for many of the technologies shown in the movie are based on solid visions of a possible future, as foreseen by a cast of technical advisors who helped Spielberg to make the movie. Spielberg actually hired a team of experts to get a clear idea of what the future might look like in... 2054.

The story happens in the year 2054, so let me tell you this, now: "Welcome to the future."

Because the idea behind iBeacons it's exactly what you just saw in this short movie. And so the objective of my talk tonight is to help you bring an answer to questions such as "What is iBeacon?", or "How does iBeacon work?" or even

“When should I use it?”, or even better yet, “When should I not use it?” And not only that, but also “Where can I buy iBeacons?”, “How can I use iBeacons?” and finally the very important one, “Why should I care?” — so, yeah, lots of questions.

To answer all of those questions, and to give you a frame of reference for your understanding, I’m going to describe iBeacons using four dimensions:

1. Marketing
2. Technology
3. Usability and User experience
4. Security and Privacy

Each of these dimensions will provide us with a focal point where we can direct our attention, so that we can understand the implications of this new technology. I guess each of you are responsible for at least one of the bullet points in the slide behind me, so I hope that this overview will give you a much required perspective of the whole iBeacon thing.

## Marketing

So let’s start first with the “Marketing” aspect. How many of you are in charge of marketing tasks in your companies? What are the main tasks that you have to deal with? Set up campaigns? Engage your users? Get feedback from them?

The official definition of marketing is the “process of communicating the value of a product or service to customers, for the purpose of selling that product or service.”

Making the customer buy our products takes us to great lengths. Lots of different strategies exist, all leading to the great holy grail of Marketing, where the product is so specifically tailored to the customers’ needs that they just cannot avoid getting it.

I am using here the word “Marketing” in the most generic sense, making a direct reference to all of its related concepts, such as product marketing, pricing, distribution, service, retail, brand management, account-based marketing, analysis, research, segmentation, strategy, social marketing, and of course identity.

In order to increase the interest in your product, to customise and to adapt a product, the first thing you have to do is to know the customer. Or at least to be aware of this magic word called “Context.”

And Context has a lot to do with location. Knowing where the user is gives marketing teams a strong foothold, but until now, location information was hardly of any utility when indoors. Thanks to those GPS chips in our pockets, it’s become very hard to lose oneself in the wilderness, so to speak. We know where we are at any time. Heck, we even know where our family and friends are at any time, but we could not, until now, pinpoint locations correctly in short distances or in indoor situations.

The basic premise of iBeacons is to provide a simple solution for low-range location services. They are an IPS: an Indoor Positioning System (or Micromapping system,) like many other similar systems, by the way.

iBeacons enable very interesting scenarios, because they can relate to any kind of marketing activity, such as advertising, branding, direct marketing, personal sales, product placement, publicity, sales promotion, loyalty marketing, mobile marketing, premiums, prizes and much more.

For example. Imagine that you are in a clothing shop; how about getting information about those shirts, or a special notification about a spot offer on socks, or some quick information about the latest promotions, or the quality of a particular clothing item? How about checking out quickly and securely as soon as I arrive to the cash register?

Take a museum for example. What about ditching those clunky museum guided tours by a more on-the-spot experience, where you actually receive information about that author, period, work of art or special exhibition as you move close to it? What about having your museum application automatically giving you the contextual information about the period in Roman history where the sculptures in the current room have been made?

Of course the notion of “indoors” is vague; what about a stadium? Of course we can use the GPS in it, but even with all the precision of our satellites out there, it is still very hard to know if you are close to seat B-134R, or if the closest emergency exit is at your right or your left, or if the closest bathroom is less than 5 minutes away by foot, or where the closest hot-dog seller is.

The same ideas could be applied in conference centres, and at Trifork we know a lot about that, because we have our own GOTO conferences all over Europe; who is the next speaker in this room? What is the name of current speaker in this room? What is the wifi password in this room? Where is the nearest emergency exit? And so on and so forth.

But let’s move further away; what about music festivals, like the one in Nyon near Geneva? I don’t know if you’ve been to the Nyon Paléo Festival, it’s an incredible festival held every year in July with great artists. It happens in a large field outside of the city, where usually 3 or 4 acts happen at the same time in rather muddy conditions (don’t forget your rain boots if the weather is nasty!) So, in that context, many questions arise, and iBeacons can provide interesting answers too. For example, what’s the name of that singer in the main châteaueau of the Festival? Where’s the nearest toilet? (that’s an important question after some glasses of your favourite drink) Where’s the emergency room? (an important question after far too many glasses of that drink of yours) Where’s the nearest kebab shop? (don’t forget to eat while you drink!)

Finally, even more important: what about hospitals and healthcare? How about doctors being able to get instantaneously information about a particular patient just by getting closer to the bed? How about family members being able to lo-

cate the closest waiting room in that huge maze of buildings, elevators and hallways that are modern hospitals? How about being able to quickly pinpoint the location in the building of Dr. Smith, who happens to be the only available expert in heart surgery right now? Can you imagine the sheer number of episodes of ER and Grey's Anatomy such scenarios would yield?

Seriously, iBeacons enable these and many other interesting scenarios, in which consumers, visitors, public and attendees can get contextual information, maximising the value they get out of "they being there" at that moment of time.

On the other side of the equation, of course, we have the magic word "Analytics" coming up. Gathering all the information you have from the movements of your users "in situ" you can know, in real time, the most popular places, the most visited, the most interesting, get instant contextualised feedback from users at any given time, just by tracing their physical movements in the premises of your mall, shop, stadium, museum or conference centre, all of this leading to increased fidelity and retention of your customers.

Indeed, all of this sounds like Nirvana.

I hope you all agree with me in the extraordinary disruptive potential of such a technology, and I hope that you are all, just like I am right now, wondering about the countless possibilities, as well as the important risks that such a knowledge brings.

Because, you know, with great power comes great responsibility.

I am going to talk about some of the risks involved tonight, but for the moment suffice to say that it's quite incredible to think that all of this was very quietly introduced by Apple last year, and that it is already available in most of the world's pockets, where the tools are already installed and waiting for you to come up with ideas.

## **Technology**

Now let's talk about Technology. How are iBeacons implemented? What are iBeacons?

The most important thing to know about iBeacons is that they are based on an open standard: Bluetooth 4.0, also known as "Bluetooth Smart", is a standard since June 2010. Bluetooth 4.0 consists of three protocols, "Classic Bluetooth" for backwards compatibility, "Bluetooth High Speed" based on Wifi standards, and "Bluetooth Low Energy" also known as Bluetooth LE.

"iBeacon" is an open standard based on Bluetooth LE, released by Apple, and in no way it is restricted to Apple devices, such as MacBooks or iPads. Any device that has the required Bluetooth LE hardware and software can interact seamlessly with iBeacons.

Apple has trademarked the name "iBeacon" and has extended the MFi program

aimed to external hardware manufacturers, in order to be able to sport the official iBeacon logo shown in the slide behind me, and to ensure a minimum level of compatibility among manufacturers.

But what about NFC, or “Near Field Communication” as it is known? NFC is another IPS (Indoor Positioning System) that is fairly popular in the Android world; indeed both BLE and NFC can be seen as competing technologies, but there are a few key differences between them:

1. BLE has a much broader range than NFC, up to 50 meters in ideal conditions, usually a maximum of 30 meters;
2. A much faster data transfer speed;
3. Really faster setup time;
4. About the same power requirements;
5. BLE offers cryptography off-the-box, while NFC may not;
6. Both use a different frequency range.
7. In terms of their “nature”, NFC tags are mostly passive, which means that they just reflect the signal emitted from the smartphone, just like passive RFID tags; on the other hand, iBeacons are active, they emit their own signal thanks to an embedded power source. Which leads to...
8. A much higher cost. The price difference between NFC and iBeacons is big, indeed.

From a pure technical standpoint, iBeacons themselves can be thought of just as small emitting antennas using Bluetooth LE signals.

The beacons themselves, and this is very important, do not contain any logic or are in any way “aware” of their surroundings. They only broadcast, 24/7, a fixed signal to their immediate surroundings with a 2.4 GHz frequency, just like any other Bluetooth device would do.

Let me repeat this point: **iBeacons do not push anything to your device; it is your application that triggers the notifications and actions to be displayed at any time.** Just like a lighthouse in the shoreline, an iBeacon broadcasts a simple signal to whoever wants to listen; it is up to the captain of the ship (in this case, your application) to correctly interpret the signal and to take the right decision.

Thus, what contains the logic and intelligence about beacons are either Apps (distributed through the usual channels, like the App Store or similar) and Passbook items (like coupons or event tickets) both of which can “listen” to iBeacons and prompt the user to perform activities or to provide them with additional information. This is by design, to ensure that the end user is always ultimately in control of the user experience, and is able to get rid of annoying applications at any given time.

What iBeacons emit is three pieces of information:

1. A “unique universal identifier” which is a machine-generated, weird sequence of characters that is guaranteed to be unique across time and

- space;
- 2. A “major” integer number;
- 3. A “minor” integer number.

UUIDs look like shown in the slide, and there can be at most  $3.4 \times 10^{38}$ ; this number is so large that you could have created  $7 \times 10^{20}$  UUIDs every second since the Big Bang and there would be still new values coming up.

How are these values used? Let’s look at an example, for example this typical corner of a typical city like New York with all of its isometric buildings. Let’s say that a small coffee shop store has a couple of branches throughout the city; the first branch, the main branch, would start the rollover of iBeacons and would then choose a UUID for itself. The first iBeacon, thus, would have that UUID, and a major and minor values equal to one. In this particular business, the owner chooses to equal “major” with “branch”, and so when the second iBeacon is installed in the main branch, it gets a “minor” equal to two, but the major is still one.

Now, as soon as new branches install iBeacons, they will use the same UUID, but the “major” number will of course be different.

Meanwhile, throughout the city, other businesses roll their own iBeacons, and each business chooses to give different meanings to the “major” and “minor” numbers.

To summarise, each UUID is meant to be used on a single store, hospital, building or other location, and an application will listen typically to just one UUID. The “major” and “minor” numbers can be assigned any semantic that you see fit; branches and beacons, floors and rooms, seat row and number, it’s up to you to decide what they mean in your context.

In terms of distance, iBeacon sensing can be roughly categorised in three distance regions:

- 1. Immediate, up until half a meter;
- 2. Near, up until 2 meters;
- 3. Far, up to 30 meters.

Your own application should filter the values depending on the distance required by each use case, and present information to the user in a contextual way.

In terms of compatibility, currently iOS 7, Android 4.3, BlackBerry 10 and OS X 10.9 Mavericks ship with off-the-box support for BLE. In the case of iOS and OS X, this is both for emission and reception; any iOS device or OS X computer with the minimum requirements shown in the slide behind me can become iBeacons, enabling interesting scenarios in your own applications.

From a point of view of hardware, all iOS devices released since 2011 have BLE support built-in.

Some Android devices have support for detecting iBeacons as well, the most

important of which are enumerated in the slide behind me. By the way, there is an open source Java library on Github published by Radius Networks, for those of you who are into this kind of geek stuff, that simplifies the use of iBeacons in Android applications.

In the case of Blackberry there are several devices on the market that are already compatible with BLE, in particular the Q10, Z10, Z3, Z30 and the Porsche Design P'9982 (which is the one that Beyoncé uses, if you are interested in celebrities.) BlackBerry has published code on Github that shows how to consume iBeacons from your BlackBerry applications.

Windows Phone is a bit behind as we speak, because even if Windows Phone 8.1 has software support for BLE connections, it does not offer (yet) a public API, which means that at the moment WP developers cannot include support for iBeacons in their applications. Another problem is that currently the latest Nokia devices ship with Bluetooth 3.1, not with 4.0, which would prevent the software from working, anyway. The support for BLE has been announced for later this year.

But what about other platforms?

If you are using Xamarin and C# to create cross-platform apps, here's a bit of sample code on Github that will show you how. Please note that for the moment this code is only compatible with iOS and Android devices, but it should work with Windows Phone devices at some point in the future.

For those of you using PhoneGap to create cross-platform solutions, there is a project in Github that will surely interest you; an (at the moment) iOS-only plugin, where the developers are right now working on the Android compatibility layer, and which would help creating cross-platform solutions using this framework.

The same can be said about Appcelerator Titanium, here you have a module that will most certainly help you.

If you are a “low-level programming” kind of guy, you will be happy to know that you can use C and directly link to the “bluez” library for your apps. Which takes me to a command-line app for setting and testing your beacons, as well.

And let's not forget about Node.js; if you need to have your server-side app interact with beacons, here you go.

Oh, and of course you can use an Arduino or a Raspberry Pi to create your own iBeacons; which is exactly what I have done for tonight!

Finally, we have also iBeacon-enabled sunglasses. Which means that iBeacon-enabled contact lenses are just a couple of years away. Which means that iBeacon-enabled eye implants are just a decade or two away. Which means that Mr. Yakamoto will be greeted in GAP with blinking eyes sooner than you think.

And we've closed the circle.

Let's talk now about iBeacon providers. Who builds iBeacons and how much do they cost? I've got here a quick panorama of providers to help you choose the best provider of iBeacon technology.

There are many companies shipping different kinds of iBeacons, these are the ones I found out, but there might be of course many more; in the table you can see the price ranges, and whether or not these providers display the "iBeacon Certified by Apple" logo in their website:

- Alibaba.com <http://www.alibaba.com> is of course worth a check in any case, as a simple search for "iBeacon" yields hundreds of different results. You might want to know that based on reports by colleagues and friends, the quality level of the beacons found through this channel varies considerably, and for example in many cases they feature low quality batteries and no security at all. So, be warned; you may get what you pay for.
- Appflare <http://www.appflare.com>
- Estimote <http://estimote.com> - they are probably one of the best-known providers of iBeacons right now.
- Glimworm Beacons <http://glimwormbeacons.com>
- IoT Design Shop <http://www.iotdesignshop.com/beacon>
- Kontakt.io <http://kontakt.io>
- Onyx Beacon <http://www.onyxbeacon.com>
- PassKit <https://passkit.com/buy-ibeacon/>
- Radius Networks <http://www.radiusnetworks.com/ibeacon/>
- Roximity <http://roximity.com>
- Stick & Find <https://www.sticknfind.com/Beacons&iBeacons/>
- Twocanoes Software <http://twocanoes.com/bleu-station> Some providers do not give information about pricing:
- BlueCats <http://www.bluecats.com>
- Gimbal (a Qualcomm company) <https://www.gimbal.com>
- JAALEE [http://www.jaalee.com/beacon\\_en.html](http://www.jaalee.com/beacon_en.html)
- Rococo Software <http://www.rococosoft.com>
- shopkick <http://www.shopkick.com/shopbeacon>
- Swirl <http://www.swirl.com/platform.html#beacons>

As you can see, the price range varies considerably, from CHF 22 to CHF 52 per beacon, with an average of CHF 30. By ordering in bulk you can lower the price per beacon up to 16 or 17 CHF per beacon. Some companies do not advertise prices online, while others offer considerable discounts for bulk orders.

There are as well some marketing management platforms that take iBeacons into account, here mentioning:

- Adobe Marketing Cloud
- Appflare Cloud
- inMarket
- Passjoy

- PassMarket
- Pushmote
- Roximity Platform
- Swirl

I would like to point out that Trifork does not endorse any of these brands nor guarantee their operations or products, and this information is offered here as a guideline and an orientation.

## Usability and User Experience

Now, let's move to the third part of our talk of tonight, about Usability and User Experience. We all know that Apple is all about the “user experience” of their products, and of course iBeacon is not an exception; the whole BLE vs. NFC debate was cut short internally at Apple after the UX designers realised the potential for immersive experiences thanks to the characteristics offered by BLE. In terms of usability, the first major issue with iBeacons is the multiplicity of applications that users will be required to have in their devices in order to take advantage to them. This means three things:

1. iBeacon is right now the wild west. First to arrive grabs it all.
2. There is a market window of opportunity for aggregators, like malls and shopping centers, to centralize beacon information in their own applications.
3. Users will start dismissing apps that are simply too annoying in terms of notifications and activations, and only those apps that are not pushy, irrelevant and that really provide value will win.

By the way, even if the user does not delete the app in case of annoying behavior, remember that there is a “master switch” for iBeacon: users are able to block its access to location information; doing so will actually disable any iBeacon functionality in your apps, so you'd better do things right to begin with.

Another important point to consider is that there are actually two ways iOS devices can consume and interact with iBeacons:

1. The first is Apps, of course; an app can be programmed to “sniff” for nearby iBeacons, and to change its own behaviour depending on the closest beacon.
2. But there is another means, which does not require an ad-hoc app, it is much cheaper to implement and use, and one that integrates wonderfully well with iOS devices and users; Passbook. Indeed, passbook items such as tickets, coupons, boarding passes and others can be “iBeacon-aware” and they can automatically appear in the home screen of the user when they are close to a particular beacon.

We are going to see both interactions in the demos right after.

Finally, the most important thing to remember: an iBeacon is not just a glori-

fied QR Code, ok? They are much, much more; first of all they do not require any user intervention (a priori at least) and they are much more discrete visually. Even better, using Passbook, QR Codes and iBeacon can work together seamlessly.

Some best QR Code practices apply to iBeacons, for example:

- Make sure iBeacons serve a real purpose
- Pay attention to the placement of the beacons
- Disclose their benefit to users
- Test them!
- Track them!

As much as possible, we should avoid with iBeacons the reaction we have had with QR codes, particularly after some failed attempts to use them properly.

## Security and Privacy

Finally, the last part of our talk, Security and Privacy. I am first going to tackle a little threat management here, just disclosing some issues that can arise when working with iBeacons:

- Hijacking iBeacon username and password
- Stealing UUIDs and spoofing users
- Battery drain
- Management
- Connectivity / Compatibility
- Cost (Theft, insurance, etc)

In terms of privacy issues, you have to keep in mind that iBeacon are the real life equivalent of a browser cookie. You know, browser cookies? Those little pesky files that help marketing teams to track you while you browse around the web?

Just as with browser cookies, iBeacons also generate their own privacy issues; what happens with the data that you will gather through your application?

Whenever you go to a website like Twitter, you see a disclaimer that explains users that you are using cookies to track them; should we have similar banners in our shops now?

The most important thing to remember now is that we should apply all the knowledge we have from previous “live marketing” experiences, such as QR codes, privacy scandals and other issues, to actually avoid them now with iBeacons. In particular, brace for the first scandal that will arise after some company misuses this technology, because I think it could happen really fast.

## Case Studies

Here a small, quick list with major iBeacon implementations from around the world:

- Apple Stores in the US, to help the customer find their products on the stores.
- Virgin Atlantic (with Estimote) for Passbook coupons for free items.
- MacWorld / iWorld, for a scavenger hunt with prizes (with Twocanoes)
- Major League Baseball (MLB) for helping users find their way in stadiums.
- National Basketball Association (NBA)
- Macy's (with shopkick)
- Consumer Electronics Show (CES)
- United Nations Museum in NYC, where they simulate a minefield to raise awareness on the personal mine problem.
- SXSW Festival for attendee check in and badge pickup, and interactive sessions.
- BeHere app: track students attendance in classrooms.

For an updated list of iBeacon use cases, be sure to check [this page](#).

## Conclusion

So, what is the future of all this?

As always with Apple, speculation is a dangerous game. Everybody knew that Apple was going to release a cell phone, but clearly nobody expected the iPhone, the App Store and later the iPad to change the way we interact and consume information in such a profound way.

It is very tempting to speculate with payments as the next possible step for Apple. Indeed, iBeacon-powered apps can detect their presence near to an iBeacon-emitter point-of-sale application, triggering a dialog between both devices and making the payment process as easy as with NFC. Actually PayPal is moving in this direction too, and they are pushing very hard their own standard for BLE beacons... so there will be lots of movement in this area in the next few months.

And, by the way, if this payments rumour turns out to be true, believe me, you will be happy to have some Apple stock in your portfolio. But then again, you haven't heard this from me or Trifork at all!

In any case the important thing for me now is to give you the promised four answers to the questions asked at the beginning of this presentation; here they go:

1. Marketing —> “Minority Report” & Analytics
2. Technology —> Bluetooth LE & “Lighthouse”
3. Usability & UX —> Apps & e-Wallets
4. Security & Privacy —> Cookie & Annoyance