



# Beacon Bible 3.0

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# What readers say

<b>Feedbacks &amp; comments</b>	<p>“Hey Andy, I was just reading your document, the ‘iBeacon Bible’ and thought it was very well done. I spend a lot of time talking to people about iBeacon technology, Bluetooth LE, etc., and I thought your piece was excellent.” <b>David Cunningham</b>, Co-founder The Code Project</p> <p>“Oh! I know the Bible well – great great work!!” <b>Doug Thompson</b>, “BEEKn” publisher</p> <p>“I just wanted to say thank you for publishing the iBeacon Bible. It’s really helped me to craft a better conversation with my clients along with communicating ideas &amp; concepts better with my engineers.” <b>Alexander Kim</b>, VP Mobile Partnerships, Blue Bite</p> <p>“Your Gaia-Matrix website on iBeacons and iBeacon Bible is the most helpful I have seen.” <b>Sean Kenealy</b>, Sales Marketing Manager, Google360</p> <p>“I downloaded the ‘iBeacons Guide 1.0’ and I’m impressed by the huge amount of useful information it delivers. It’s more than just overview of the iBeacon technology , It’s an enabler. Great guide Andy.” <b>Marco Dini</b>, Software Engineer, Telepass</p>
<b>Others...</b>	<p>The iBeacon Bible was cited by:</p> <ul style="list-style-type: none"><li>• "iBeacon" on Wikipedia (<a href="https://en.wikipedia.org/wiki/Ibeacon">https://en.wikipedia.org/wiki/Ibeacon</a>)</li><li>• "Hyping the iBeacon" on labs@tmw (<a href="http://labs.tmw.co.uk/2014/01/hyping-the-ibeacon/">http://labs.tmw.co.uk/2014/01/hyping-the-ibeacon/</a>)</li><li>• The Code Project (<a href="http://www.codeproject.com/Articles/732709/iBeacon-Bible-1-0">http://www.codeproject.com/Articles/732709/iBeacon-Bible-1-0</a>)</li></ul>





# Preface

<p><b>Who am I...?</b></p> <p><i>New/updated content →</i></p>	<ul style="list-style-type: none"><li>• I'm Andy Cavallini</li><li>• I'm an engineer</li><li>• I'm a Sr. Project Manager and Business Analyst</li><li>• I design, implement and manage <u>retail business solutions</u> for companies such as:<ul style="list-style-type: none"><li>- <b>Nectar - Aimia Group</b> (loyalty service provider)</li><li>- <b>Finiper, Coop</b> (<i>big-box</i> retailers)</li><li>- <b>Toshiba Global Commerce Solutions</b> (IT solutions for retail)</li><li>- ...</li></ul></li></ul>
<p><b>Contacts</b></p> <p><i>New/updated content →</i></p>	<p>Feel free to contact me via email: <a href="mailto:andy.cavallini@outlook.com">andy.cavallini@outlook.com</a></p> <p>My personal blog-site is: <a href="http://www.gaia-matrix.com">http://www.gaia-matrix.com</a></p>





# Rules of engagement...

<p><b>Apple, Google and the history of Beacons</b></p> <p><i>New/updated content →</i></p>	<p>Let me retrace the (...very short...) history of Beacons.</p> <p><b>Apple:</b></p> <ul style="list-style-type: none"> <li>launched iBeacon technology at its <b>World Wide Developer Conference</b> in 2013</li> <li>later added iBeacon support to <b>Passbook</b> – as a matter of fact, a small but valuable step into the direction to have an <i>App-less</i> interaction with iBeacons (<i>we'll discuss this topic in a while...</i>) <i>...by the way, it's a pity that <b>Passbook</b> is not available on iPads...</i></li> <li>recently announced it would <i>iBeacon-enable</i> <b>Apple Wallet</b> and its <b>iAd</b> platform (apparently through <b>Offers</b>, a new <i>iAd wrapper</i> on <b>Apple Wallet</b>)</li> </ul> <p>Trouble is...</p> <p>...iBeacon tech is offered by <b>Apple</b> just on <b>iOS/OS X</b>, not on any competitors' platforms – for instance <b>Google Android</b>...</p> <p>...fortunately several software companies created solutions that allow also <b>Android</b> (and <b>Windows Mobile</b>, <b>Blackberry</b>, etc.) Apps to receive iBeacon notifications – still, <u>there is no official <b>Apple</b> support or backing.</u></p> <p>This situation certainly makes it more difficult for big companies – think <b>Wal-Mart</b>, <b>IKEA</b>, ... – to invest millions of dollars on this technology.</p> <p>After a long wait, in July 2015, <b>Google</b> launched a full Beacon development framework that includes the open source <b>Eddystone</b> spec for Beacon broadcasting, together with additional tools, <i>bells</i> and <i>whistles</i> – for example <i>Eddystone-enabled</i> <b>Chrome 44</b> for iOS.</p> <p><b>Finally an official Google Beacon platform is available.</b></p> <p><b>Digression: Eddystone Beacons and Google's ecosystem</b> ...it's quite probable that in the future Google will <i>Eddystone-enable</i> also <b>Google Now</b>, <b>Google Calendar</b>, <b>Google Maps</b>, <b>Google Play</b> and so on – let's wait and see...</p>
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<p><b>Apple's iBeacons</b></p> <p><b>vs.</b></p> <p><b>Google's Eddystone Beacons</b></p> <p><i>New/updated content →</i></p>	<p>Basically, we have now<sup>(*)</sup>:</p> <ul style="list-style-type: none"><li>• Apple's <u>iBeacons</u></li></ul> <p><i>and</i></p> <ul style="list-style-type: none"><li>• Google's <u>Eddystone Beacons</u></li></ul> <p>(*): I'm writing this in August 2015</p> <p>Google's <u>Eddystone Beacons</u> <b>apparently</b> are a super-set of <u>Apple's iBeacons</u>, in other words, <u>Eddystone Beacons</u> can behave like <u>iBeacons</u>, but have additional features and functionalities.</p> <p>Why "<b>apparently</b>"? Because at the time of writing we're waiting for more from <b>Google</b> (...and from <b>Apple</b> too!)</p> <p>From a functional/business point of view, what's the most significant difference between Google's <u>Eddystone Beacons</u> <b>and</b> Apple's <u>iBeacons</u>? Let me simplify:</p> <ul style="list-style-type: none"><li>• Apple's <u>iBeacons</u> broadcast cryptic numeric identifiers, that is, UUIDs</li><li>• Google's <u>Eddystone Beacons</u> broadcast traditional web addresses (e.g. <a href="http://www.gaia-matrix.com">http://www.gaia-matrix.com</a>), that is, URLs</li></ul> <p>More about it later, don't worry...!</p>
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<p><b>How is my Beacon Bible structured?</b></p> <p><i>New/updated content →</i></p>	<p>To reflect the fact that the Beacon technology is significantly evolving, my Beacon Bible is changing too:</p> <ol style="list-style-type: none"><li>1) The original “<b>iBeacon Bible</b>” title drops an ‘i’ and becomes “<b>Beacon Bible</b>”</li><li>2) Current version 3.0 is divided in two parts:<ul style="list-style-type: none"><li>- <b>Part 1</b> explains the basic concepts of this technology and of proximity marketing using <u>Apple’s iBeacons</u> as a reference model</li><li>- <b>Part 2</b> starts to present the specificities of <u>Google’s Eddystone Beacon</u> framework and tools, in particular <u>Chrome 44</u> for iOS</li></ul></li><li>3) Since things are evolving fast, several concepts true in August 2015 risk to get obsolete quite quickly: be patient and feel free to visit my personal blog-site (<a href="http://www.gaia-matrix.com">http://www.gaia-matrix.com</a>) for updates</li><li>4) By the way, if you are involved in Retail, don’t hesitate to download my new ebook titled: “<b>Omni-channel Retail Bible</b>” (→ October 2015) from my personal blog-site (<a href="http://www.gaia-matrix.com">http://www.gaia-matrix.com</a>).</li></ol> <div data-bbox="810 1048 1061 1406" data-label="Image"></div> <p>I'll make you fall in love with improving <i>in-store</i> shopping-experience and with retail omni-channel integration... <i>Beware, I won't always paint you a pretty picture...!</i></p>
<p><b>Call-to-Action!</b></p> <p><i>New/updated content →</i></p>	<p>My Beacon Bible 3.0 Call-to-Action is: <b><i><u>ask for more!!!</u></i></b></p> <p>...email me at <a href="mailto:andy.cavallini@outlook.com">andy.cavallini@outlook.com</a></p>





# Part 1

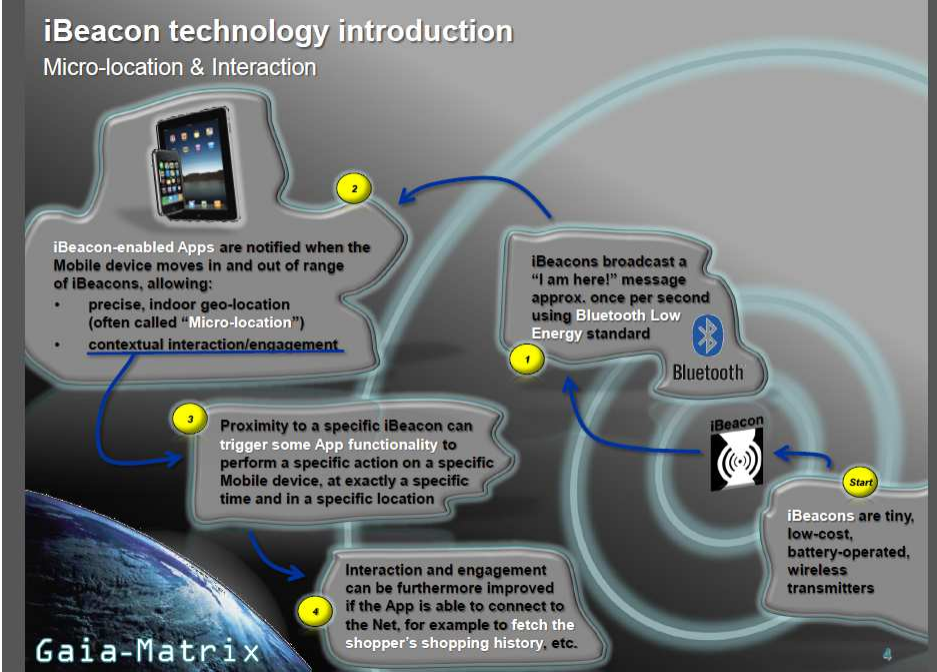
Basic concepts using Apple's iBeacons  
as a reference model







# Introduction to iBeacon technology



A very simplified explanation of iBeacon technology at work

<h2>iBeacon technology in a few words</h2>	<p>“iBeacon” is the name <b>Apple</b> chose for a particular technology that allows Mobile Apps (running on millions of recent iPhones, iPads, etc.) to know how close they are to tiny, low-cost, wireless transmitters called “hardware iBeacons” (or just “iBeacons”).</p> <p>It’s important to note that iBeacon technology isn’t an Apple’s monopoly: all recent <b>Android</b> devices already support it too.</p> <p>iBeacons broadcast signals using the well-known <b>Bluetooth Low Energy (BLE)</b> standard, allowing precise, indoor geo-location (often called “Micro-location”), but also contextual interaction/engagement, as proximity to an iBeacon can trigger some specific App functionalities.</p> <p><b>Digression: iBeacons (short) story</b></p> <p>In 2013 Apple subtly introduced iBeacons as part of iOS 7 at WWDC 2013 (Worldwide Developers Conference), though it revealed the feature only in a single keynote slide and didn't go into detail at all...</p>
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<p><b>Fancy a simple iBeacon Use Case as a starter?</b></p>          <p><b>Let's get back to iBeacon technology: two valuable key concepts...</b></p>	<p>Of course there is more to iBeacon technology, but before entering into the details, let's see in advance a simple Use Case to understand the benefits of this technology (more Use Cases are described later on).</p> <p>[To know more about support and compatibility, refer to the <b>iBeacons hardware and software support</b> section]</p> <p>[To read additional interesting Use Cases, refer to the <b>iBeacons Use Cases</b> section]</p> <p>Let's pretend that Joe is a shoes store-owner and that Jane is a loyal shopper who installed Joe's store iBeacon-enabled Mobile App on her iPhone (or Galaxy S-<i>whatever</i>).</p> <p>Jane is visiting Joe's store; an iBeacon mounted under a store-shelf will be able to alert Jane's iPhone that she (Jane, loyalty-card #28746) is in a particular physical location, for example in front of Nike shoes, and potentially allows Joe to monitor her behaviour (for how long is she looking at Nike shoes?).</p> <p>Thanks to this technology, Joe is able to serve Jane customized offers (for example a discount-coupon for Nike shoes) according to her behaviour, shopping history, etc.</p> <p>That's just the tip of the iceberg – there is a lot more Joe could do using iBeacon technology.</p> <p>[To read additional interesting Use Cases, refer to the <b>iBeacons Use Cases</b> section]</p> <p>To better figure out how iBeacon technology works, we have to understand two key concepts: <b>Micro-location</b> and <b>Interaction/Engagement/Context</b>.</p> <p><b>First key concept: Micro-location</b></p> <p>iBeacon technology allows your Mobile device to understand its position, even in indoor locations where smartphones or tablets are not able to pick up GPS signals from satellites overhead – that's geo-location with a very high level of granularity, conventionally known as <b><u>Micro-location</u></b>.</p> <p><b><i>Digression: about current geo-location technologies</i></b></p> <p>It's difficult for radio signals to go through the bricks, steel and glass of buildings, that's why GPS doesn't work well indoors; moreover Global Positioning System is not suitable for reliably determining distances within 15/20 meters – so road-navigation is ok, indoor location (especially in multi-floor buildings) is not.</p> <p>You could object that modern geo-location technologies also triangulates signals from cellular towers or Wi-Fi hotspots where GPS is partially available (or not available at all); that's true, but anyway the results are quite approximate considering both stability and precision.</p>
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How does fine-granularity positioning work? It's simple, iBeacons-enabled Apps on your Mobile device are notified when the device moves in and out of range of iBeacons, and are able to monitor the distance as their proximity changes over time.

This allows Apps to know precisely where they are not in terms of a map-location using longitude and latitude (like GPS does), but considering where the Mobile device is relative to known points.

***Digression: iBeacon-enabling a Mobile App***

Existing Mobile Apps need to be upgraded to be iBeacon-enabled, but fortunately the impact from a software development point of view is quite limited.

For example, a retailer may already have a Mobile App shoppers use to manage their loyalty-card and to receive coupons; this App could be easily upgraded to also interact with iBeacons installed in the retailer's chain of stores.

Let's talk about hardware iBeacons: they are little battery-operated radios you can place wherever you want; if your Mobile device gets within range, it senses iBeacons and locates itself.

iBeacons broadcast a "I am here!" message more or less ten times per second to any device within range of the Bluetooth Low Energy radio signal; since each iBeacon has its own ID, the Mobile device can tell them apart and recognize the context of the world around itself.

Note that iBeacons broadcasts have no data payload: they just identify themselves via customizable IDs.

[In **Part 2** below, you'll see that [Google's Eddystone Beacons](#) broadcast URLs instead of customizable IDs]

[To know more about iBeacons IDs, refer to the **iBeacons IDs** section]

Using strategically installed iBeacons, your smartphone or tablet work out where it is with an extraordinary degree of precision – an accuracy far higher than that of GPS.

[To know more about iBeacons spatial accuracy, refer to the **iBeacons location precision** section]

**Second key concept: Interaction/Engagement/Context**

After understanding the first key concept (Micro-location), let's now talk about the second key concept: **Interaction/Engagement/Context**.

The iBeacons signals enable interaction with Mobile Apps, for example triggering some App functionality to perform a specific action on a specific Mobile device – at exactly a specific time and in a specific location.

In other words, iBeacons signals express two valuable concepts at the same time: "This is where you are" and "This is what you (can) do".

iBeacons therefore make it possible to effortlessly engage with people in a physical space through their Mobile devices.

**Two key concepts recap**

Creating a smart location-oriented infrastructure provides Mobile devices with contextual info based on the environment they move through; iBeacon technology can be leveraged to make Apps aware of the user's context: who is she AND where is she (at a specific time); this feature allows a new level of interaction and engagement – that can be furthermore improved if the App is able to connect to the Net, for example to fetch the user's shopping history, updated info about traffic or the weather, etc.





## Features of the iBeacon technology

Let's shed some light on other interesting features of the iBeacon technology: here we have a list of items in no particular order.

### **Item #1: Mobile App automatic start**

Mobile devices will automatically react to when they come within range of iBeacons: there is no need to take your smartphone out of the pocket to manually start the pertinent iBeacon-enabled App.

[Please note: today this is true for Apple devices, not Android ones]

iBeacons are identified in the background by iOS or Android, and the right App is started when necessary; in technical words, an App can register with the Operative System to be started when specific types of iBeacons move in the range of the device.

Of course you have to install the relevant iBeacons-enabled App before you can actually enjoy iBeacons benefits – currently there is no mechanism to auto-install Apps.

[This important concept will be discussed again later, in **Part 2**]

### **Item #2: Energy consumption**

I know what you are thinking: geo-location and Bluetooth combined are batteries drainers.

Don't worry, actually Bluetooth Low Energy standard (*...as the name implies...*) is very, very battery friendly.

### **Item #3: Hardware iBeacons deployment**

Hardware iBeacons are very easy to set-up and deploy; consider also that they are quite low-cost and will become almost free when critical mass (and economies of scale) will be reached; there are already a lot of hardware companies selling iBeacons on the web.

### **Item #4: Internet connection**

No connection to the Net is necessary (even though accessing valuable resources in the cloud is always beneficial), so your 3G data-plan won't be affected – and there is no need to switch Wi-Fi on as well.

### **Item #5: From listening to broadcasting**

So far we have considered Mobile devices passively receiving signals from hardware iBeacons, but Mobile devices can also actively transmit signals and become *de facto* iBeacons – opening your Mobile world to new useful possibilities.

A person with a Mobile device in the pocket performing as an iBeacon is able to trigger action around her (for example switching lights on, unlocking doors, etc.) just by announcing her vicinity to devices listening for it via Bluetooth Low Energy.

By the way, many desktop/laptop computers are iBeacons-enabled too, and that opens up further opportunities.

### ***Digression: iOS vs. Android***

Android 5 devices (or later) can pose as hardware iBeacons.





Thinking about it, iBeacons could significantly push the concept of **Internet of Things**, a network of connected “smart” physical objects we can interact with.

[To know more about support and compatibility, refer to the **iBeacons hardware and software support** section]

**Item #6: Steps to have a fully functional iBeacon-enabled App**

There are actually four steps that must be taken by the final user to have a fully functional iBeacon-enabled App:

1. have the App downloaded and installed
2. have Bluetooth on
3. the App must be able to access location data ← opt-in
4. the App must be able to receive notifications ← opt-in

Any additional privacy-related authorization depends on the specific application.

**Item #7: “Monitoring” vs. “Ranging”**

When you get into the details of iBeacon technology, two verbs – “monitoring” and “ranging” – are quite often abused; let me shed some light:

- monitoring – determining when a device has entered or left an iBeacon’s coverage area (monitoring is typically performed by the operative system in the background)
- ranging – determining the distance (*Immediate, Near, Far*) from an iBeacon (it’s not possible to perform this activity in the background on iOS; it is apparently doable on Android)

***Digression: iOS vs. Android***

iOS doesn’t allow to sense iBeacons around if you ignore their Proximity UUID; in other words, you need to know the Proximity UUID of the iBeacons beforehand in order to detect them; on the contrary, Android allow you to see any iBeacon regardless of its Proximity UUID.





# iBeacons Use Cases

<p><b>iBeacons for retail</b></p>	<p><b>Are iBeacons born for retail?</b>  The level of targeting that iBeacon technology provide could greatly change how brands and companies interact with customers and improve their shopping experience; that’s why retailers – above all others – are paying so much attention, and some proofs of concepts and <i>pilots</i> are already underway in selected stores in Europe and in the USA.  Marketers want to join the party too, since iBeacon technology is sparking new marketing ideas: advertising probably won’t be the same any more.</p> <p>Let’s see some interesting Use Cases.</p> <p><b>Contextualized deals</b>  iBeacon technology allows to convey specific, customized deals to shoppers based on the time/day/..., which aisle they’re in (remember the first key concept, <b>Micro-location?</b>), their purchase history, their loyalty profile, etc. (apply here the second key concept, <b>Interaction/Engagement/Context</b>)  Think of very customized offers; for example a shopper has checked an item in store but did not purchase it: the retailer can offer the shopper a discount via email or directly on the Mobile device the next time she enters the same store (or another store of the same chain).</p> <p><b>Monitoring shoppers behaviour</b>  Monitoring shoppers behaviour (store visits, walking-paths, etc.) is another possibility: for example the iBeacons system allows the retailer to know (in real-time) that the shopper has been standing in front of one specific display for more than three minutes; sensing second-by-second a shopper’s (<i>inferred</i>) interest about a specific product, the system can supply additional information such as online reviews and – talking about fashion – other available styles or colours. As you go on shopping, a blue tie might (metaphorically) tell you: “I’m perfect with the gray suit you purchased here last week”.</p> <p>You can even do real-time A/B testing (a method very dear to online marketers, that allow to directly compare the results of different marketing initiatives) with different displays in multiple stores: which one gets the most attention?</p> <p><b>The online/offline integration (a.k.a. “omni-channel integration”)</b>  The retailer can gather, for instance, if the shopper visited the same store or other stores of the same chain, which shelves/items she checked there, if she previously went online on the retailer’s website to check out the same or different items, and so on.  Come to think about it, iBeacon technology allows an effective integration of online and offline shopping, for example a customer may shop in a retailer’s store and, while there, picks also up the items purchased the evening before on the retailer’s ecommerce site.</p>
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	<p>That's what retail experts call "<b>omni-channel integration</b>", the beneficial merging of the online and the offline shopping experience. iBeacons make things like abandoned online shopping-cart follow-up a realistic opportunity for brick-and-mortar stores.</p> <p>Furthermore, the integration of online and offline analytics allows, for instance, to evaluate conversion-rates that can help maximize ecommerce and in-store sales at the same time.</p> <p><b>The big deal for retail is...</b>      Acquiring a wealth of information on in-store shopping behaviour in real-time <b>prior to purchase</b> – that's the big deal.      Let me explain; shopping in brick-and-mortar stores hasn't evolved much during the past 100 years: shoppers enter a store, get hold of the items they need, pay them and then carry their purchases out of the store.      Traditionally, shoppers' behaviour can be realistically deduced only at the end of the shopping process, at payment time – when the loyalty-card and all the purchased items are scanned by the cashier.      So far real-time shoppers behaviour monitoring has been possible only online; but from now on – using iBeacons – this tremendous opportunity is available also in-store.</p> <p><b>Shopper-engagement</b>      Let's make an example of shopper-engagement: in a DIY-store the iBeacons system could allow a shopper to receive a notification regarding an upcoming workshop session he may wish to attend to – topics of interest can be automatically deduced considering his purchase history, surveyed hobbies, etc.</p> <p><b>iBeacons in a small neighbourhood store</b>      iBeacons potentially are ideal for big retailers with huge store chains, but could as well be conveniently employed in small stores, with very limited investments; a mom and pop store can easily iBeacon-enable the Mac (or iPad) already used for their POS system, so coupons automatically come up on shoppers' Mobile devices when close to the cashier's desk – cheap, simple, but effective.</p> <p><b>Retail: a recap of what we learned so far</b>      Remember the wise words of John Wanamaker? "Half the money I spend on advertising is wasted; the trouble is I don't know which half".      Retailers can now target the right shopper, in the right place, at the right time, interactively engaging her in new ways – while learning in real-time from her movement patterns and behaviour.</p> <p>Could shopping with your Mobile device as a loyal assistant become a reality? Or are shoppers too "conservative"? Only time will tell, however consider that today a fast increasing number of consumers already use their smartphones during shopping to investigate and compare products – so let's consider this nascent habit already in place.</p>



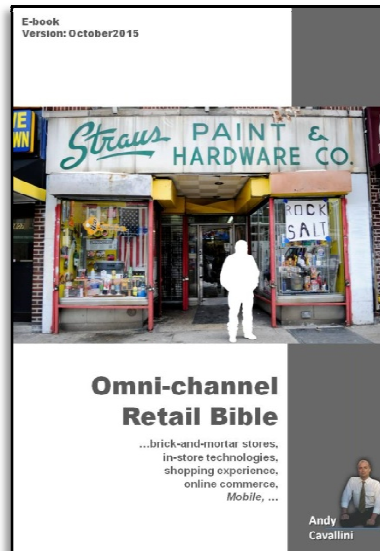


**Coffee-break...  
...and a reminder...**

[New/updated content →](#)

*It's coffee-break time...*

Reminder: if you are involved in Retail, don't hesitate to download my new ebook titled: "**Omni-channel Retail Bible**" (→ October 2015) from my personal blog-site (<http://www.gaia-matrix.com>).



I'll make you fall in love with improving *in-store* shopping-experience and with retail omni-channel integration...

*Beware, I won't always paint you a pretty picture...!*







## Some important considerations about iBeacon technology in Retail

### “Colonization” of Mobile devices by Retailers

Location-based Marketing is about reaching consumers **in the right place and at the right time** with interactive content, media and services adapted to an individual’s current physical location.

More easily said than done: how do you *practically* and *effectively* do it?

Mobile devices in general, and smartphones in particular, are instrumental for indoor positioning, shopper-behaviour monitoring, customer targeting and engagement – especially if iBeacon technology is employed.

That said, we (consumers) have to be prepared for a proliferation of geo-localized, iBeacon-enabled Mobile Apps – “ideally” one for each store/shopping mall/chain of petrol stations/supermarket/... we frequent.

Will our smartphones be colonized by Retailers? (...*actually, the right question is, will we allow it to happen?*)

We (consumers) are going to differentiate between the retailers we truly feel like hearing from and those we’d rather not – therefore we’ll decide which Apps to install, keep or remove.

It’s that simple!

As somebody brilliantly told me, “...the success of any advertising [Location-based Marketing included] is grounded in trust – and trust is non-negotiable. If you don’t trust the advertiser, you almost always refuse to interact with that company, much less buy their products. Bernie Madoff investment advice, anyone?”.

Message to retailers: please, PLEASE, make every effort to be trustworthy – it’s in your own best interest.

Another point is: will these iBeacon-enabled Apps be all the same?

I fear that I’m going to receive tons and tons of tedious notifications like “*Andy, if you buy product X now (it’s on the shelf in front of you!), you’ll get an additional 10% discount, just because it’s you!*” and nothing more – what a bore!

The exceptions – those few Apps able to separate themselves from the pack – will effectively improve my shopping-experience; the rule is: “...provide enough value, and (*probably*) they will come...”.





### **Need of analytics solutions to extract timely and actionable information**

In Retail there's no scarcity of data, companies "that sell" have been amassing it for decades – think of purchase-stats, loyalty-profiles, financials and so on.

In recent years Ecommerce sites, above all, are data-hydrants that retailers have trouble to drink from: mouse-clicks, abandoned-carts, visited-pages, etc. have been challenging the capacity of even modern, performing Business Intelligence/Reporting/Big Data solutions.

Next analytics hurdle after Ecommerce?

**iBeacons** and Proximity Marketing, of course.

Now, due to iBeacon tech, detailed, granular data about in-store walk-paths (and a lot of other shopper-actions) will congest even the most advanced "Big Data" analytics systems, making the job of Business-analysts – in simple words, **going from raw data to useful business insights** – very, very hard.

New, more effective (retail-focused?) analytics solutions are needed: tools able to easily, rapidly and intuitively interpret huge quantities of real-time data-points to **extract timely and actionable information**.

The goal is to make data more readily accessible not only to Business-analysts, but even to store personnel (those that interact with shoppers every day), enabling them to quickly and successfully work with data through a simple interface that removes the necessity to learning SQL or other complex Big Data querying methods.

At the same time, the integration with existing BI/Reporting/Big Data solutions could prove to be very beneficial, allowing all users to ingest, clean-up, search, refine and visualize data within a single (and possibly familiar) platform.





## **iBeacons ~~for retail~~ in other situations**

### **Are iBeacons just for retail?**

iBeacons are not just for retail, there are a lot of other situations where applying the two key concepts of this technology (Micro-location and Interaction/Engagement/Context) can prove to be very valuable.

### **Museums and exhibitions**

Visiting a museum or an exhibition will be a different experience thanks to iBeacon technology: micro-location and interactivity allow visitors to get information about the objects or products they are seeing and to be timely notified of pertinent events, sessions, workshops, etc.

At the same time, it's possible to track which expositions attract the most foot traffic.

### **Mass transit**

Think about the value of iBeacons in an airport or in a train station.

Interested, for instance, about a train travel App that is aware of which train you are travelling on, and – as you board – automatically starts plotting your train's real-time progress?

Fancy an airport interactive guide that shows you the shortest way from Check-in to your Gate?

### **Healthcare**

There could be also very important healthcare applications; imagine a doctor visiting patients: his iBeacon-enabled tablet could precisely know about its location inside the hospital, and automatically fetch the information for a specific patient – saving time and avoiding dangerous mistakes.

### **Sport events**

In a sport stadium your Mobile device could direct you to the fastest route from the parking-lot to your seat.

### **Parking-lots**

Don't remember where you parked your car?

In a multi-floor parking garage your Mobile device could help to quickly find your exact parking space.

### **A final recap**

iBeacons are quite flexible, aren't they? Innovative applications will come up every day, once critical mass will be reached; finally your Mobile device will have the chance to evolve from an high-priced time-killer (...an "angry birds machine"... ) to a valuable time-saver.







# iBeacons IDs

<p><b>How does an iBeacon identify itself?</b></p>	<p>An iBeacon identifies itself using three customizable values: Proximity UUID (128-bit), Major and Minor (16-bit each). Since they are customizable, uniqueness cannot be guaranteed.</p> <p>Therefore you have three levels to identify a micro-location: only Proximity UUID, Proximity UUID and Major, Proximity UUID and Major and Minor.</p> <p>For example, Proximity UUID identifies your entire retail company, Major identifies a specific store and Minor specifies individual shelves or different checkout tills inside each store.</p> <p>Another example: Proximity UUID identifies your museum, Major identifies a specific gallery within the museum and Minor identifies an exhibit within that gallery.</p> <p><b><i>Digression: Proximity UUID in detail</i></b> To generate a genuinely unique 128-bit Proximity UUID for any iBeacon, you can use the Mac OS X <code>uuidgen</code> command-line tool. Again, since this procedure is not mandatory or enforced (you can choose your 128-bit Proximity UUID as you like), true uniqueness cannot be guaranteed.</p> <p>[In <b>Part 2</b> below, you'll see that <u><a href="#">Google's Eddystone Beacons</a></u> broadcast URLs instead of customizable IDs]</p>
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# iBeacons location precision

<b>iBeacons ranges/regions</b>	<p>iBeacons signals allow to calculate distances in quite an approximate and qualitative way – specifically your iBeacon-enabled can monitor three ranges/regions:</p> <ul style="list-style-type: none"><li>- Immediate (less than 50 centimetres)</li><li>- Near (approximately between 50 centimetres and 2/5 meters)</li><li>- Far (more or less between 2/5 meters and 30/50 meters, depending on walls, the iBeacon output power and many other factors)</li></ul> <p>Bear in mind that – especially indoors – radio signals jump around constantly: that's why ranges are not precise.</p> <p>For the same reason, delays are artificially introduced so that region changes can be conveniently minimized when the Mobile device moves back and forth on the boundaries; to be specific, while entering a region is sensed almost immediately, leaving it is usually notified with a delay of several seconds.</p>
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# iBeacons security and privacy

<p><b>Security</b></p>	<p>Since data broadcasted by an iBeacon is public, anyone could pick up the signal and use it within an “unofficial” Mobile App: retailers plausibly don’t want third-party Mobile Apps to trigger actions on shoppers’ Mobile devices once they are in <u>their</u> stores. Or – even worse – an hacker may clone an iBeacon for some fraudulent reason.</p> <p>How to prevent hackers from "hijacking" iBeacons and mess with your micro-location infrastructure? Companies who fears for the security of their iBeacons can use effective encryption techniques to prevent unauthorized manipulations.</p>
<p><b>Privacy</b></p>	<p>Can privacy become an issue with iBeacon technology? Yes it can, actually.</p> <p>Consumers may not be pleased about the fact of being monitored by retailers at every step in the store and have the right to know how their location information (and any other data) is used. Additionally, what happens if consumers are constantly fired on with unsolicited location-based offers as they walk through town? Game over, iBeacons-enabled Mobile Apps would be considered like a plague...</p> <p><b>Some (common sense) advice for retailers</b> To be successful, iBeacons-based marketing needs to be respectful of the consumer and must improve the shopping experience – not kill it shamelessly. Message to Retailers: please, be as transparent as possible and clearly explain how your iBeacons system works and how it interacts with your shoppers’ Mobile devices; tell what data is specifically monitored and stored (and for how long). Finally, do your best to build a clear and smooth Opt-in/Opt-out process.</p>





# iBeacons & NFC

<p><b>iBeacons vs. NFC?</b></p>          <p><b>Is iBeacon technology replacing NFC?</b></p>	<p>Sometimes <b>iBeacon technology</b> is described as a competitor of <b>NFC</b> (<i>Near Field Communication</i>).</p> <p>Tell you what: NFC and iBeacons are not enemies – each technology has a specific purpose, so they may reasonably complement each other very well, especially in the Retail environment.</p> <p>NFC, in the form of cheap passive RfId tags or labels, are used to individually identify single items (and store any logistics data and other pertinent info, if needed).</p> <p>Moreover, many credit cards (e.g. Visa) use NFC for contactless payments: just tap your NFC enabled card to the little box next to the POS and you are done (no PIN is required if you pay less than a specified amount, for example €20).</p> <p>NFC is also the chosen technology for millions of mass-transit contactless cards.</p>          <p>My answer is <i>“No, I don’t think so.”</i></p> <p>Currently you can’t – at least cheaply – create an “iBeacon-card” to keep in your pocket, or an “iBeacon-label” to stick on consumer products; especially in Retail, merchandise-tracking is still a crucial area for NFC: when I select a shirt and carry it to a changing room, this interaction won’t be visible to any iBeacon/App.</p> <p>Therefore, to offer shoppers an extensive experience including smart interactions with products beyond confined areas like merchandising stands and shelves, a mixed solution involving both NFC and iBeacons definitely is the way to go.</p>
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## Part 2

### The specificities of Google's Eddystone Beacon framework and tools





# The Physical Web and Eddystone framework

<p><b>The Physical Web</b></p> <p><i>New/updated content →</i></p>	<p>The <b>Physical Web</b> is an open source web specification that <b>Google</b> released in 2014 with the goal to make it easy to interact with smart-devices in the physical world.</p> <p>Basically, <b>Google</b> want to give every smart-device in the physical world a web address (yes, a simple URL), instead of a cryptic, unique identifier such as a UUID (reminder: Apple’s iBeacon technology uses UUIDs).</p> <p>What is the big advantage of this approach? By broadcasting a URL, it is possible to go around the need for a Mobile App to interpret the meaning of the identifier.</p> <p>Let me make an example:</p> <ul style="list-style-type: none"> <li>• if your smartphone/tablet receives “11111111-2222-3333-4444-555555555555” from an iBeacon, a specific, <i>ad-hoc</i> App is needed to interpret it and understand where this iBeacon is located, what functionalities are offered, etc.</li> <li>• if it receives “http://www.cocacola-vendingmachine.com/NY-CentralStation” no particular interpretation is needed, and instead of an <i>ad-hoc</i> App installed on your smartphone, a Mobile web-browser will do</li> </ul> <p>I’ll describe the same concept from another point of view: <b>today Apple’s iBeacon technology doesn’t have an easy, dependable way to browse Beacons in close proximity and start interacting with them at once</b> – you need to have the proper iBeacon-enabled App installed first.</p> <p>Why? Because iBeacons broadcast just cryptic identifiers.</p> <p>Use web addresses (URLs) instead of identifiers, and Beacons can be detected without specific Mobile Apps already on the smartphone looking for them.</p> <p>The final goal is to be able to interact with any smart-device – for example a vending machine – without having to download and install a specific App first; <b><u>downloading and installing a specific App for each specific proximity-based service in the world</u></b> (offered for example by grocery-stores, railways stations, retailers, airports, etc.) <b>is absolutely unrealistic.</b></p>
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<p><b>Eddystone</b></p> <p><a href="#">New/updated content →</a></p>	<p>Taking inspiration from the <b>Physical Web</b>, after a long wait (in July 2015) <b>Google</b> launched a full Beacon development framework that includes the open source <b>Eddystone</b> spec for Beacon broadcasting, together with additional tools, <i>bells</i> and <i>whistles</i> – for example <u>Eddystone-enabled <b>Chrome 44</b> for iOS</u> (<i>see next section</i>).</p> <p>Finally an official <b>Google Beacon platform</b> is available... <i>...and it was about time!</i></p> <p><b>Digression: Eddystone Beacons and Google's ecosystem</b> ...it's quite probable that in the future Google will <i>Eddystone-enable</i> also <b>Google Now</b>, <b>Google Calendar</b>, <b>Google Maps</b>, <b>Google Play</b> and so on – let's wait and see...</p> <p><b>Eddystone</b> (named after the <b>Eddy Lighthouse</b> in the UK) officially is an open-source (currently available on <b>GitHub</b> under <i>Apache v2.0 license</i>) Bluetooth multi-platform Beacon protocol (compatible with Android, iOS and any platform that works with BLE Beacons), supporting <b>Google</b> services.</p> <p>Eddystone includes (at the time of writing) two APIs:</p> <ul style="list-style-type: none"><li>• the <b>Nearby API</b> makes it easier for Apps to communicate with devices and Beacons in close proximity</li><li>• the <b>Proximity Beacon API</b> allows developers associate semantic location (e.g. latitude &amp; longitude) and related data stored in the cloud</li></ul> <p><i>...more is coming, of course...</i></p> <p>The most interesting Eddystone feature is the <b>Eddystone-URL</b>, that allows Beacons to broadcast a packet type that encodes a URL (instead of an identification number) and therefore can direct users to:</p> <ul style="list-style-type: none"><li>• your website</li><li>• download your Mobile App from <b>Apple AppStore</b>, <b>Google Play</b>, ...</li><li>• a particular screen of your (already installed) Mobile App</li></ul> <p>Please note: beware, the <b>Eddystone-URL</b>'s length is 17 bytes, so a <i>URL shortening service</i> is required if your URL is longer.</p>
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# The first *Eddystone-enabled* Mobile web-browser

<p><b>Eddystone-enabled Chrome 44 for iOS</b></p> <p><a href="#">New/updated content →</a></p>	<p><b>Chrome version 44 for iOS</b> (available in the <b>App Store</b> at the time of writing) is the first <i>Eddystone-enabled</i> Mobile web-browser, bringing Beacons to the <b>Chrome <u>Today view</u> widget</b>.</p> <p>Let me get into the details:</p> <ul style="list-style-type: none"><li>• the <b>Chrome <u>Today view</u> widget</b> can be included in the <b>iOS Notification Center</b> panel</li><li>• the <b>iOS Notification Center</b> panel appears when you swipe down from the top of the screen and includes calendar-events, weather-info and other <i>so-called</i> <b>App widgets</b></li><li>• to add new <b>App widgets</b> to the <b>iOS Notification Center</b> on your iPhone/iPad, just click the <b>Edit</b> button at the bottom of the screen: if <b>Chrome for iOS</b> is installed, then the <b>Chrome <u>Today view</u> widget</b> is available and can be added</li></ul> <p>It is the <b>Chrome <u>Today view</u> widget</b> that:</p> <ul style="list-style-type: none"><li>• scans close-by Beacons broadcasting <b>Eddystone-URLs</b></li><li>• shows them (<i>ordered by proximity</i>)</li><li>• allows you to tap and instantly open the <b>Eddystone-URL</b> in <b>Chrome</b></li></ul> <p>To repeat a scan, you currently need to refresh the <b>Chrome <u>Today view</u> widget</b> by swiping down on the screen – sorry, no Beacon detection if <b>Chrome</b> is in background (<i>yet...</i>)</p> <p>The <b>Chrome <u>Today view</u> widget</b> displays:</p> <ul style="list-style-type: none"><li>• the <b>Eddystone-URL</b> Remember that the <b>Eddystone-URL</b>'s length is limited to 17 bytes? Even if a shortened URL is employed, <b>Chrome</b> will automatically expand it by following <i>redirects</i></li><li>• the web-page title</li><li>• ...more info in the future, for example the <code>&lt;meta&gt;</code> description of the web-page</li></ul> <p><b>Chrome 44 for iOS</b> is surely a <i>limited</i> first step, but it gives a hint of what is to come; the next logical step is to roll out similar (<i>...and strongly improved...</i>) features to the <b>Chrome for Android</b> web-browser.</p>
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<p><b>Privacy protection in Chrome 44 for iOS</b></p> <p><i>New/updated content →</i></p>	<p>Let's now talk about privacy protection: <b>Google</b> has put in place several restrictions to guard the privacy of <b>Chrome</b> users (...<i>these restrictions of course don't affect Eddystone-enabled native Apps...</i>):</p> <ul style="list-style-type: none"><li>• No Beacon "autoscan": currently the <b>Chrome <u>Today view widget</u></b> detects Beacons only when it is manually loaded/refreshed by the user; no background activities are allowed</li><li>• The website referenced by the <b>Eddystone-URL</b> is not contacted by the smartphone until the user decides to intentionally visit it; in this way the website cannot gather info (IP address, cookies, etc.) about "casual passersby"</li></ul> <p>Please note: to obtain the info to be displayed in the <b>Chrome <u>Today view widget</u></b>, (the final URL (...<i>following redirects...</i>) and the web-page title), the website is contacted by Google's own servers</p> <ul style="list-style-type: none"><li>• Beacon functionalities in <b>Chrome 44 for iOS</b> need to be <u>explicitly</u> enabled: the first time an <b>Eddystone-URL</b> Beacon is detected, the user is asked to <i>opt-in</i></li></ul>
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# Hardware Eddystone Beacons

<p><b>About hardware Eddystone Beacons</b></p> <p><i>New/updated content →</i></p>	<p>Several iBeacon manufacturers have already started to sell Eddystone Beacons, so availability is not an issue.</p> <p><b>iBeacons conversion to Eddystone Beacons</b></p> <p>Be aware that for many existing iBeacons a simple firmware update enables a quick conversion to <b>Eddystone</b> standard.</p> <p>What about the same Beacon alternating the broadcast of two different signals, a typical <b>Apple iBeacon UUID</b> and a “new” <b>Eddystone-URL</b>? Some manufacturers are currently working on it, so let’s wait and see.</p> <p>If you need to experiment, a few Apps (for example <b>Locate</b>) are able to transmit the <b>Eddystone-URL frame</b> to emulate hardware Eddystone Beacons – if you’re using <b>Android</b>, you’ll need <b>Android 5</b> as only <b>Lollipop</b> supports <i>transmitter-capability</i>.</p>
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# Conclusion

<p><b>The end? No, it's just the beginning...</b></p>	<p>This is the final section of the Beacons Bible, but it's not the end – there is still so much to do.</p> <p>Beacon technology is very powerful and flexible, so we (engineers, marketers, creatives, etc.) have the opportunity to create new important applications to improve the life of people and to create business value for big and small companies.</p> <p>The Beacon technology will evolve, and this Bible will evolve too, so feel free to visit <a href="http://www.gaia-matrix.com">http://www.gaia-matrix.com</a> to download new versions of this document.</p>
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# Links

<p><b>Valuable links about Beacon technology</b></p>	<p>iBeacon for developers – <b>Apple</b>  <a href="https://developer.apple.com/ibeacon/">(https://developer.apple.com/ibeacon/)</a></p> <p><b>Google's</b> Physical Web Cookbook page  <a href="http://google.github.io/physical-web/cookbook/">(http://google.github.io/physical-web/cookbook/)</a></p> <p>"iBeacon" on Wikipedia  <a href="https://en.wikipedia.org/wiki/Ibeacon">https://en.wikipedia.org/wiki/Ibeacon</a></p> <p>"Hyping the iBeacon" on labs@tmw  <a href="http://labs.tmw.co.uk/2014/01/hyping-the-ibeacon/">(http://labs.tmw.co.uk/2014/01/hyping-the-ibeacon/)</a></p>
<p><b>Other related documents by Andy Cavallini</b></p> <p><i>New/updated content</i></p>	<p>Reminder: if you are involved in Retail, don't hesitate to download my new ebook titled: "<b>Omni-channel Retail Bible</b>" (→ October 2015) from my personal blog-site (<a href="http://www.gaia-matrix.com">http://www.gaia-matrix.com</a>).</p> <div data-bbox="788 1216 1086 1637" data-label="Image"> </div> <p>I'll make you fall in love with improving <i>in-store</i> shopping-experience and with retail omni-channel integration...</p> <p><i>Beware, I won't always paint you a pretty picture...!</i></p>





