

iBeacons, BLE Beacons, and Everything In Between

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WHAT THIS IS ABOUT

This talk is:

- A “101 course” about what BLE beacons are and how they work interacting with a customer’s smartphone.
- Scrutinizing some of the natural applications that are commonly associated with BLE beacons.

THIS IS INTENDED TO HELP

- User Experience Designers
- Product Designers/Managers
- Anyone who has heard about BLE beacons and is curious about their capabilities.

THIS SESSION

- 1 BACKGROUND ON RESEARCH
- 2 LESSONS LEARNED
- 7 REALITIES WORKING WITH BLE BEACONS**
- 3 CONSIDERATIONS
- TIPS WHEN USING BLE BEACONS**
- 4 Q&A

BRICK & MORTAR EXPERIENCES



IBEACONS MAKES A SPLASH

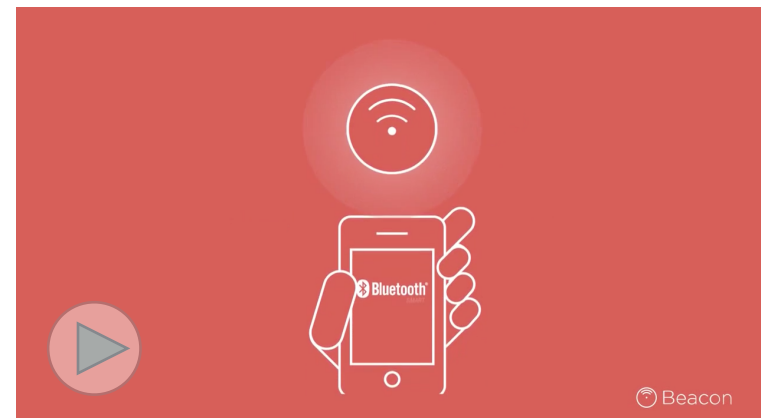
Beacons have been around for a while but with the announcement of iBeacons in 2013 there has been a lot of buzz.

“iBeacons are going to
Revolutionize Retail”

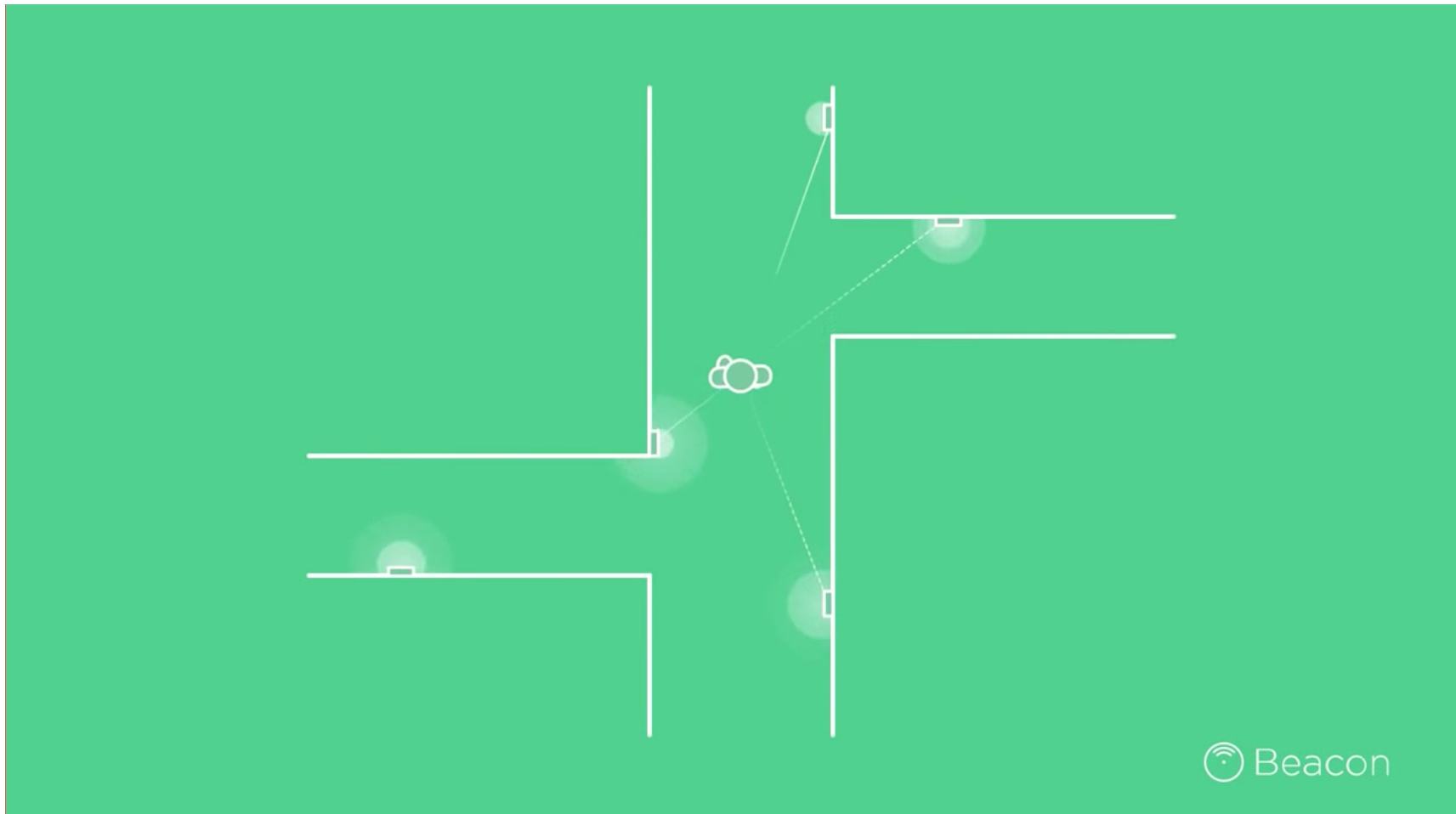
“Entering into the Age of
Context”

EXAMPLE PROMO VIDEO

UpNext's video is a great example of use-cases and functionality promised by many.



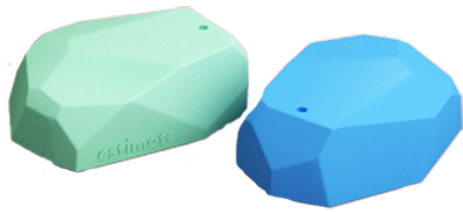
Reducing multipath interference and PO accuracy



**WE NEEDED TO
LEARN MORE.**

**LIVE EXAMPLES ARE
LIMITED...**

WE TESTED THE MARKETPLACE



estimote



Gimbal™



FOOTMARKS

AND OTHERS...

MADE OUR OWN TOOLS

1 of 3

BLE BEACONS

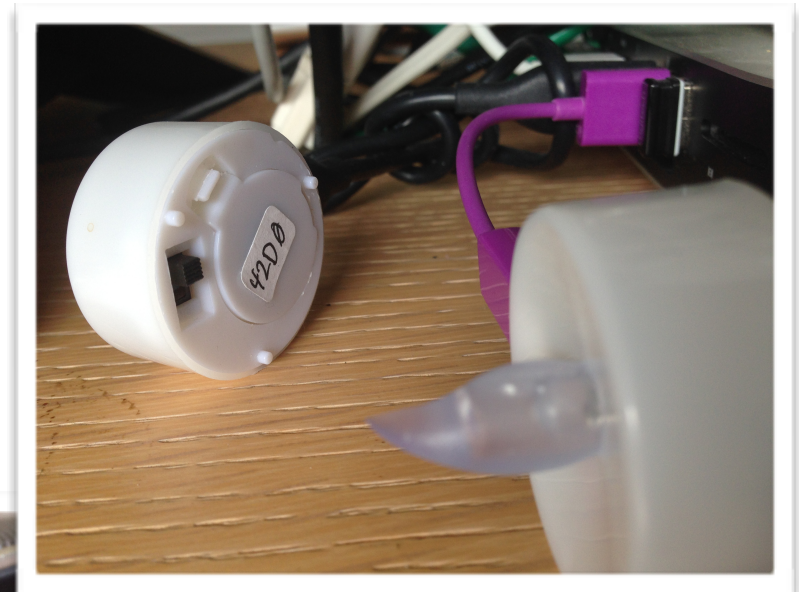
- **Removed proprietary layer**

Understand if limitation is imposed by manufacturer or the technology

- **Greater control**

Control at the firmware/hardware level

- Broadcast range
- Frequency of advertisement
- iBeacon vs. Core BLE



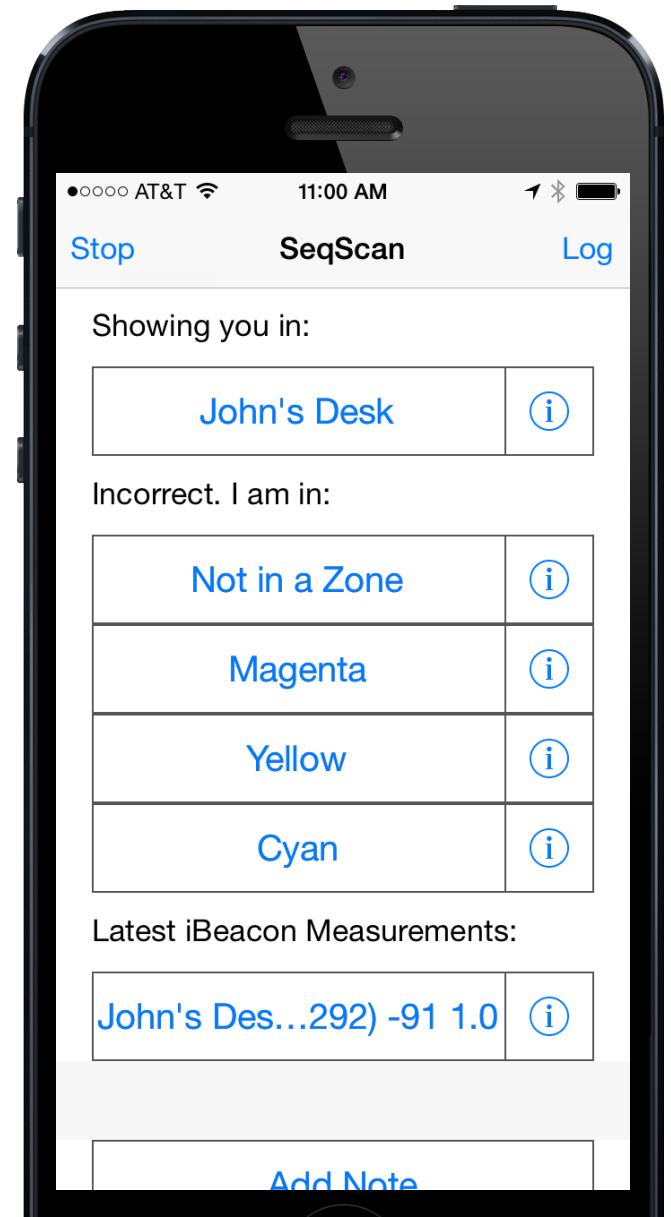
MADE OUR OWN TOOLS

2 of 3

IOS APP

To understand

- Responsiveness
- Accuracy
- Performance in different states



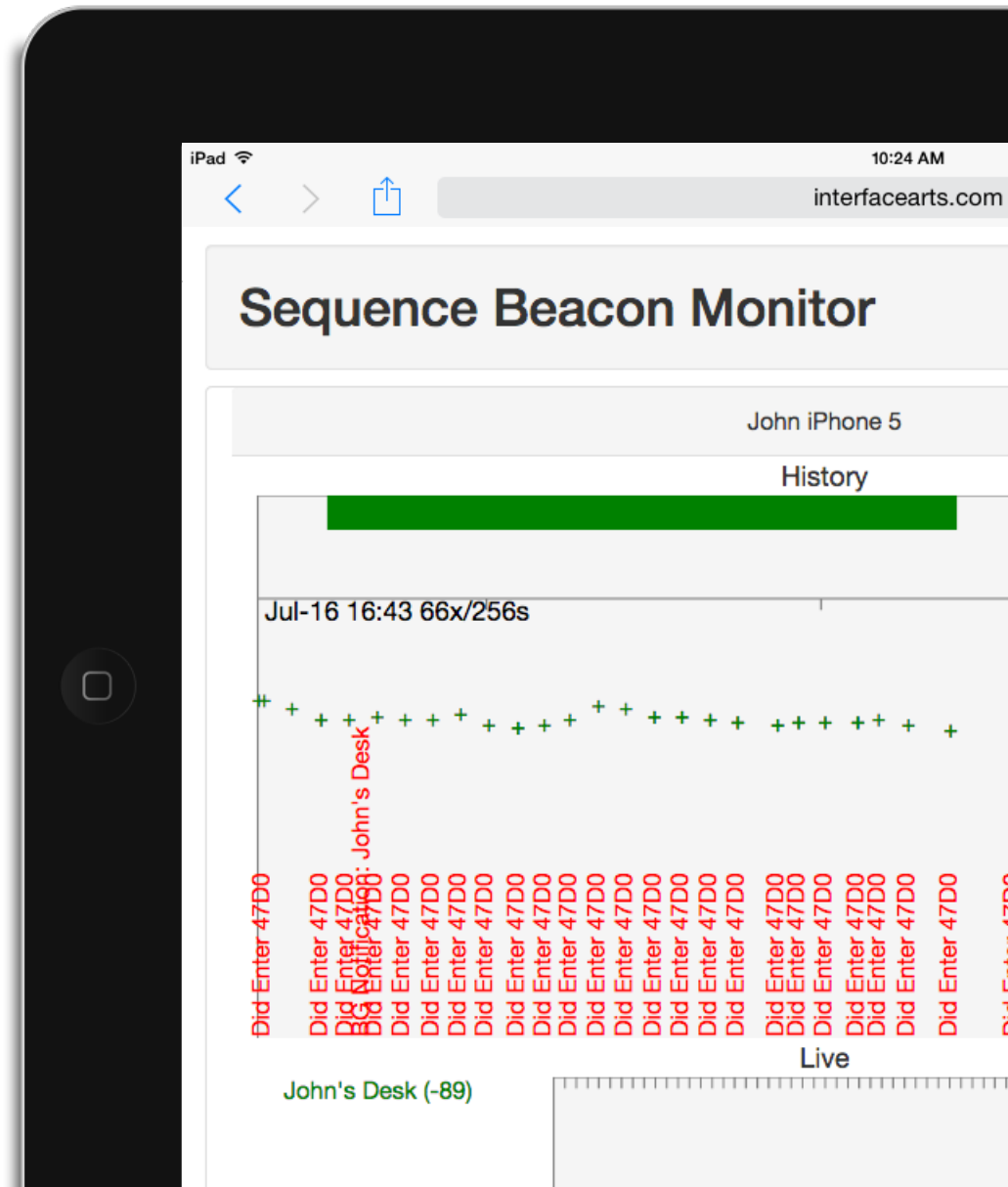
MADE OUR OWN TOOLS

3 of 3

CLOUD SERVICE

Primarily for research

- Collect historic data
- View real-time activity
- Able to experiment with logic and algorithm to refine the user's reported location



LESSONS LEARNED

**7 “REALITIES” WORKING
WITH BLE BEACONS**

REALITY 1 OF 7

BLE BEACONS AND IBEACON AREN'T THE SAME THING.

BLE BEACON IS HARDWARE

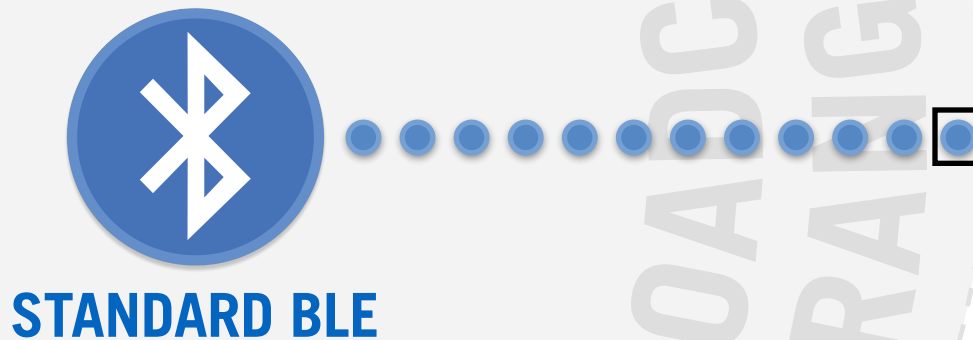
IBEACON IS SOFTWARE TECHNOLOGY

SIMPLE BLE BEACON EXPLAINED

Beacons transmit a **BlueTooth Low Energy** signal
(**BLE** or **BlueTooth Smart**)

They send out **tiny packets of identifying information.**

Each transmission is called an **Advertisement**



STANDARD BLE APPS HAVE TO BE ACTIVELY LOOKING FOR BEACONS

The relevant app should be open in the **foreground** scanning for **BLE beacons...**



STANDARD BLE

BROADCAST
RANGE



ANY
BEACONS
AROUND?

PHONES “SEE” BEACONS WHEN IN BROADCAST RANGE

... and will recognize the beacon when it comes within broadcast range and read the characteristics in its payload.



STANDARD BLE

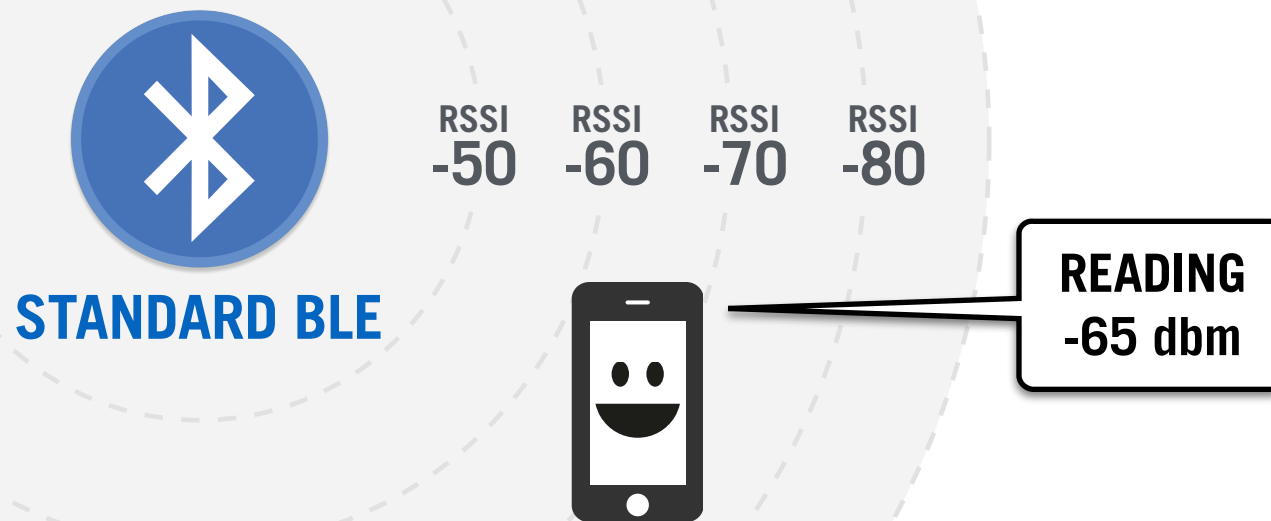


**I SEE A
BEACON!**

“HOW CLOSE TO BEACON?” = SIGNAL STRENGTH

It will then read its RSSI (Received Signal Strength Indication) to get a sense of how close it is to the beacon.

THIS IS PROXIMITY, NOT DIRECTION



IBEACONS = USEFUL WHEN LOCKED

The iPhone will range for iBeacons, even if the phone is locked...



BROADCAST
RANGE



IBEACONS = QUICK WAKE UP

iOS will give a background app a short amount of time to do something (notification, etc.) when it sees an iBeacon.



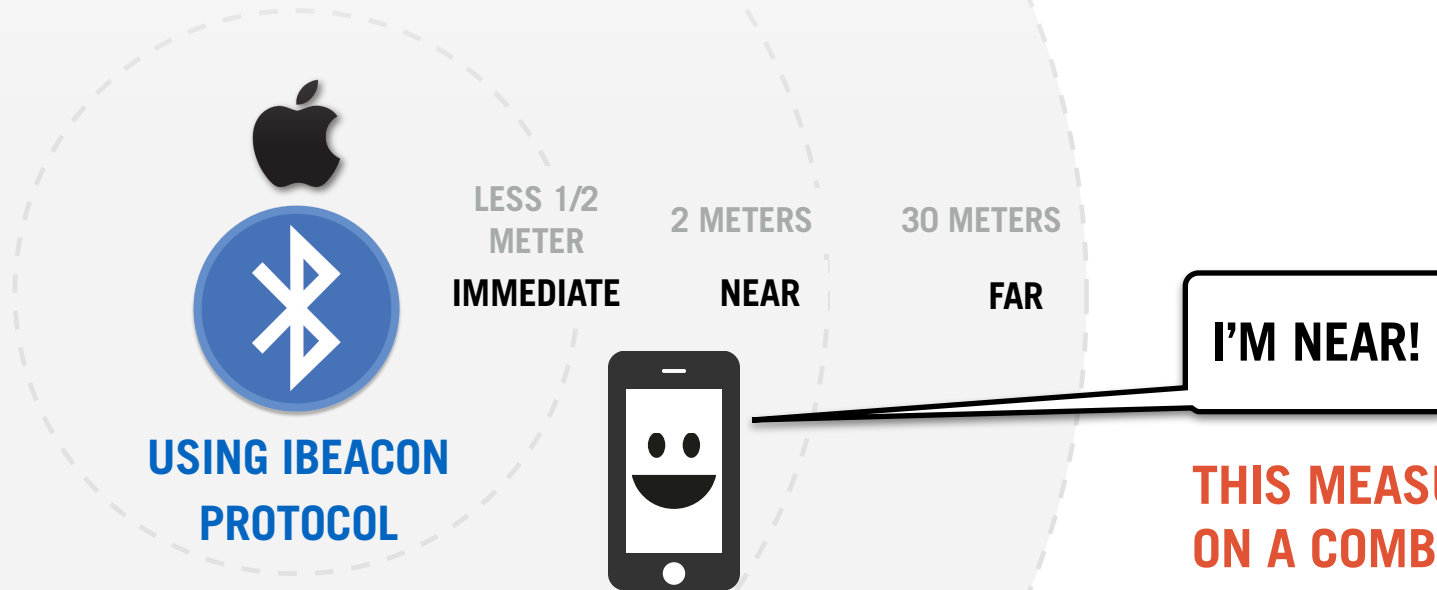
BROADCAST
RANGE



**I SEE AN IBEACON.
YOU HAVE 10 SEC.**

IBEACONS = SIMPLE PROXIMITY MEASUREMENTS

An app in the foreground can get a simple proximity measurement from iBeacons to trigger different events.



THIS MEASUREMENT IS BASED ON A COMBINATION OF THINGS BESIDES RSSI.

REALITY 2 OF 7

**DEFINING A SPACE
ACCURATELY IS REALLY,
REALLY DIFFICULT**

EXPECTATIONS OF ACCURACY

LARGE SPACES



MORE FORGIVING

VAGUE BORDERS

CONCEPTUALLY
UNCLEAR

TYPICAL “ROOMS”

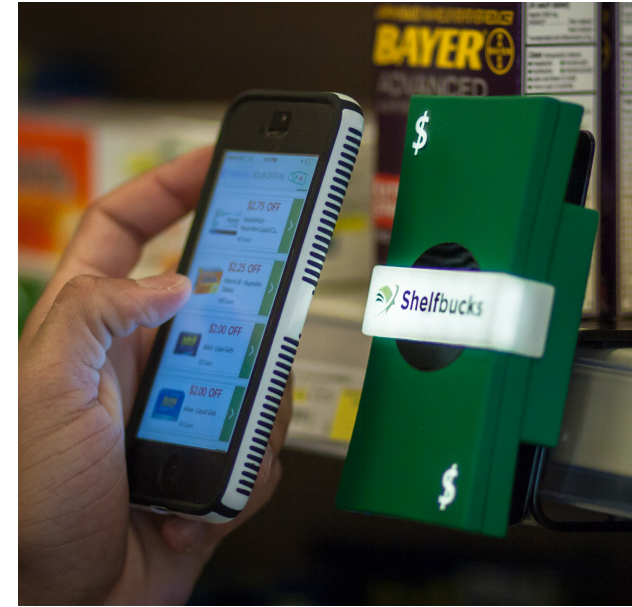


DIFFICULT

CLEARLY DEFINED
BORDERS

TOLERANCE FOR BEING
“IN” OR “OUT” IS A
SMALL % OF OVERALL
SPACE

CLOSE BY

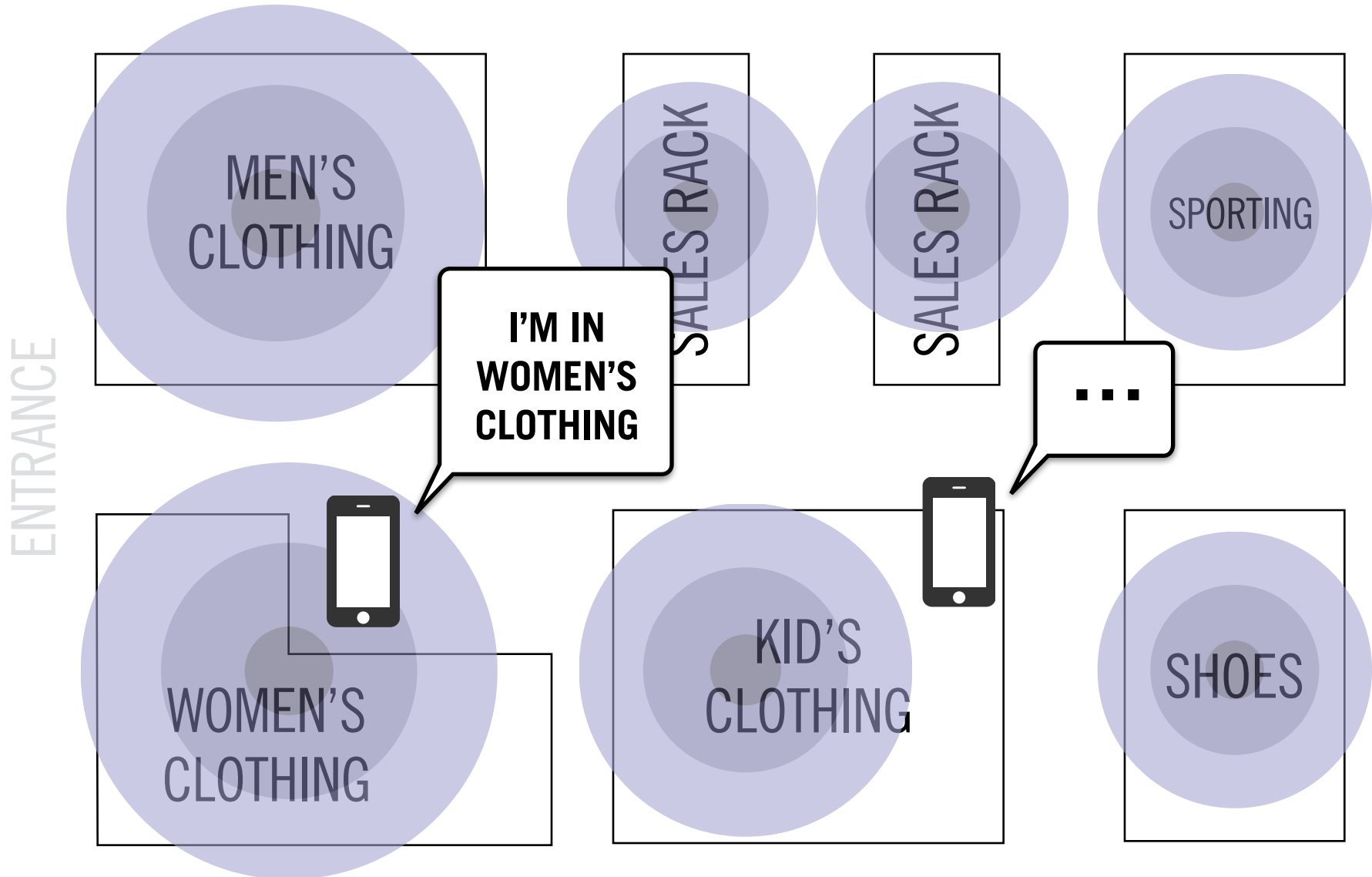


EASIER*

WITHIN SCREAMING
DISTANCE OF BEACON.

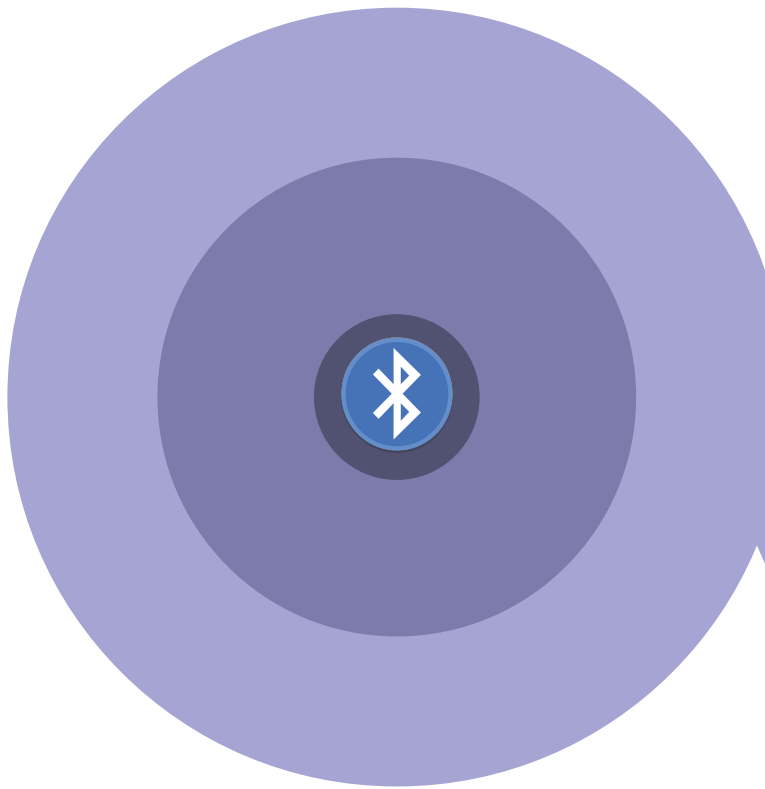
* OVERLAPPING BEACONS
CAN STILL CAUSE ISSUES

BEACONS DONT BROADCAST IN SQUARES

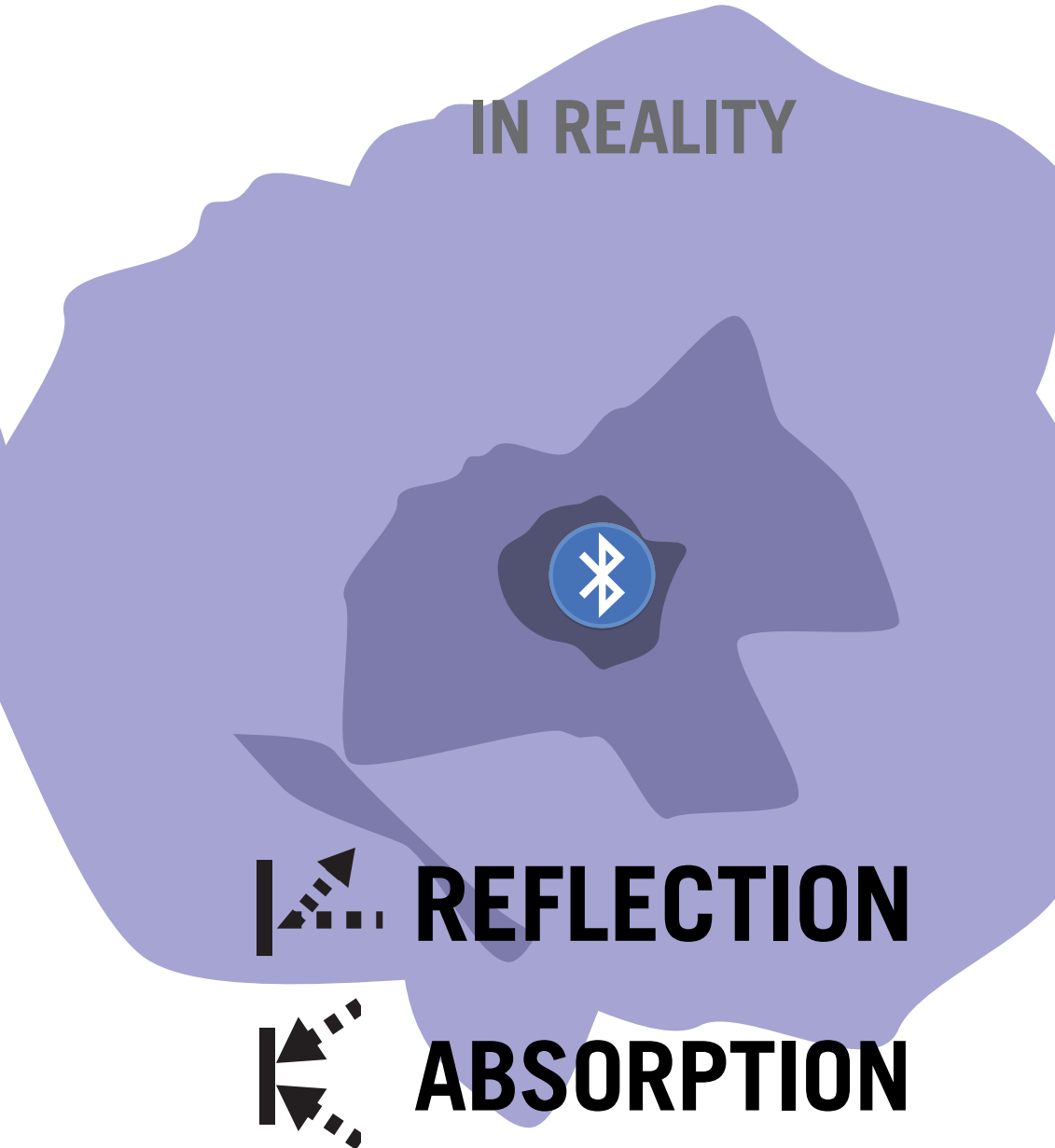


MORE IMPORTANTLY: THEY DONT BROADCAST IN CIRCLES

WHAT WE THINK...

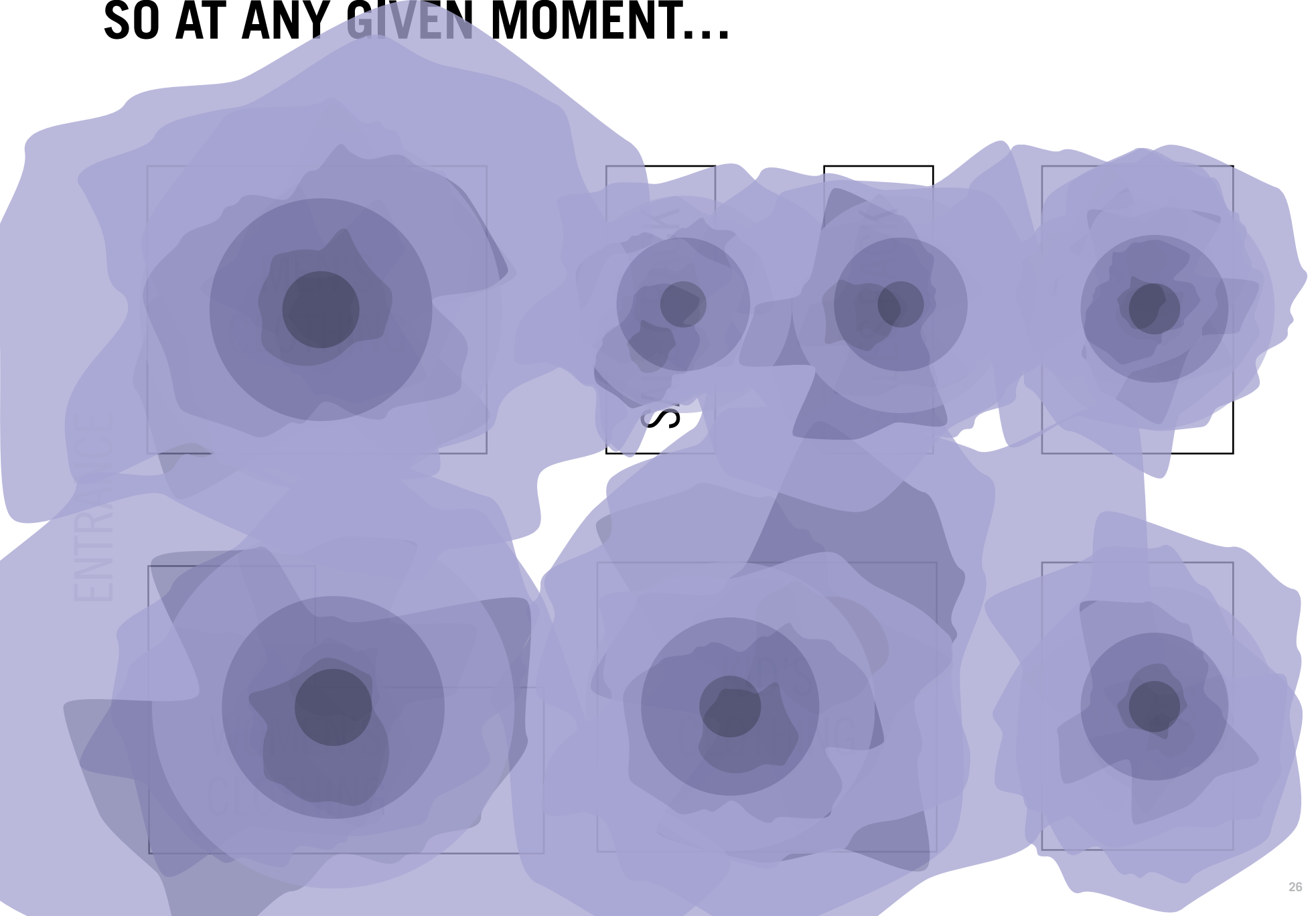


IN REALITY



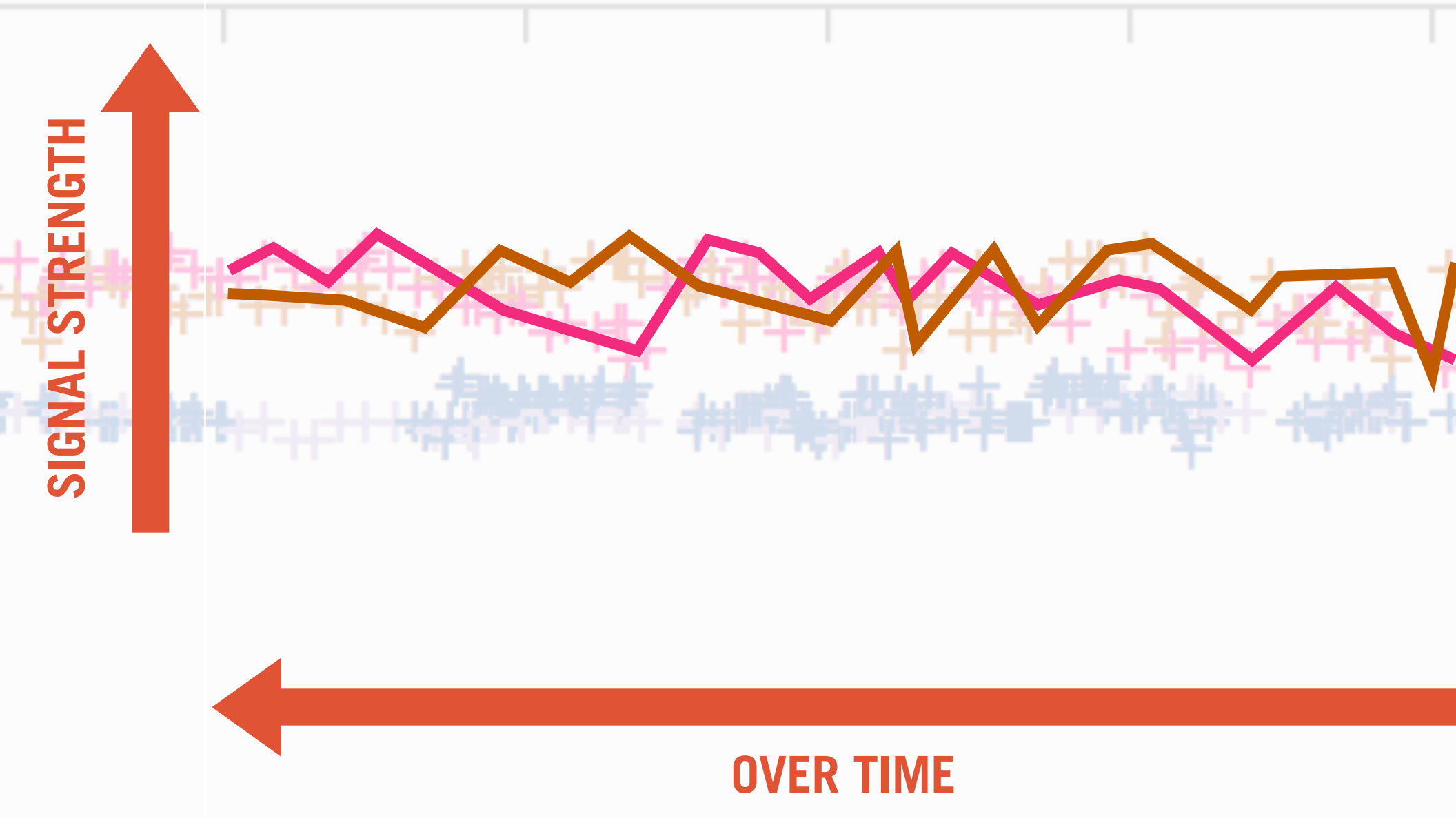
LOCATION ACCURACY IS DIFFICULT

SO AT ANY GIVEN MOMENT...



LOCATION ACCURACY IS DIFFICULT

SHIFTING SIGNALS CAN CREATE CONFUSION

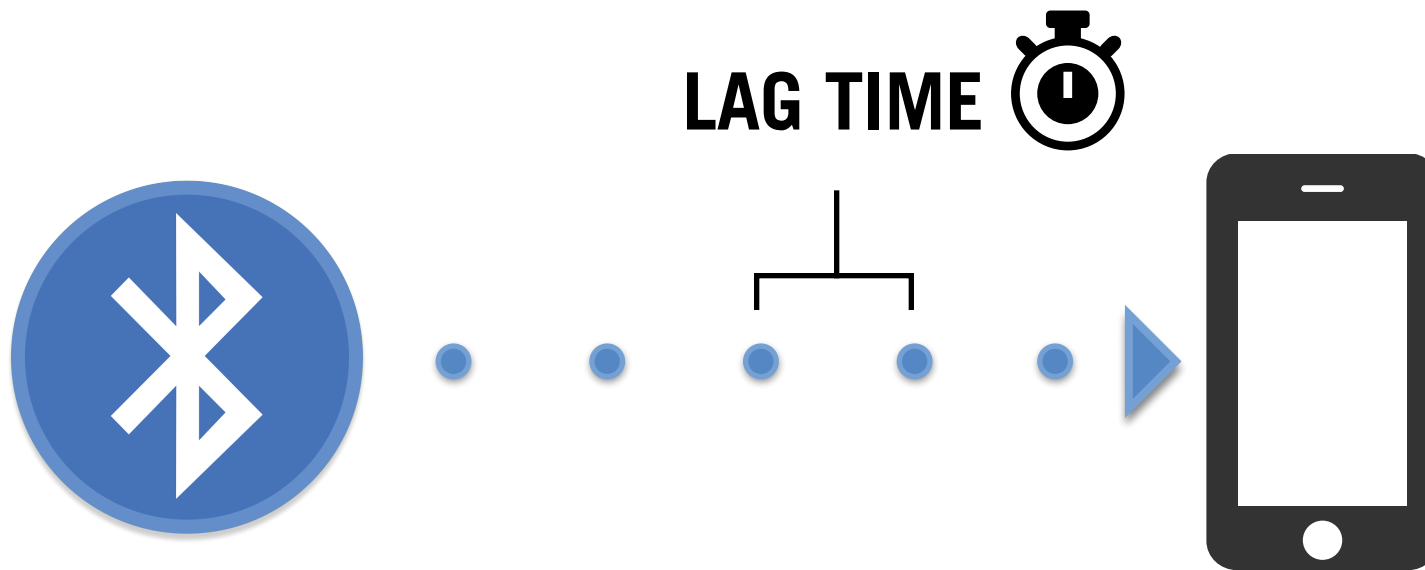


REALITY 3 OF 7

**DON'T COUNT ON BLE
BEACONS TO SUPPORT
REAL-TIME
EXPERIENCES.**

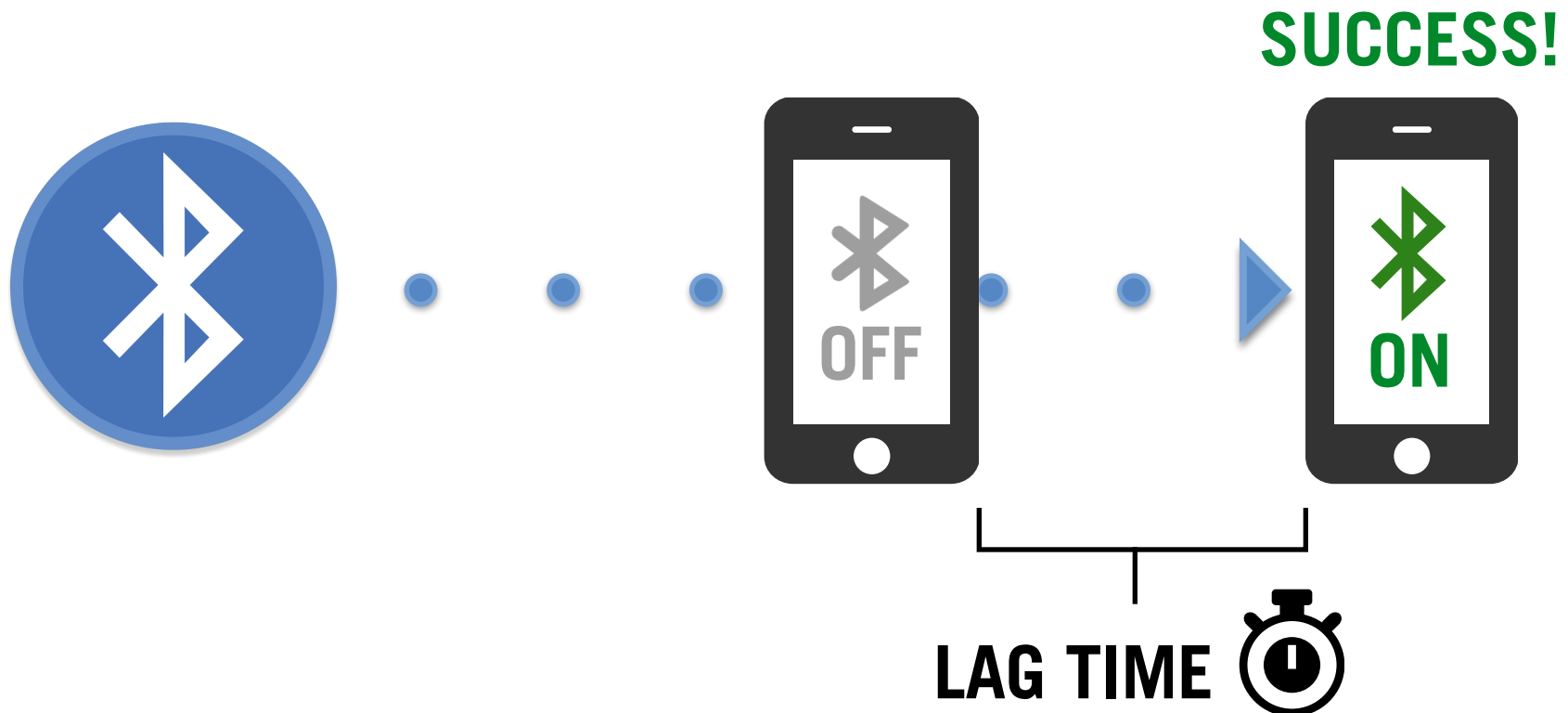
“LOW ENERGY” CAN MEAN INFREQUENT ADVERTISEMENT

One of the primary ways BLE saves energy is by advertising less. Sometimes measured in seconds.



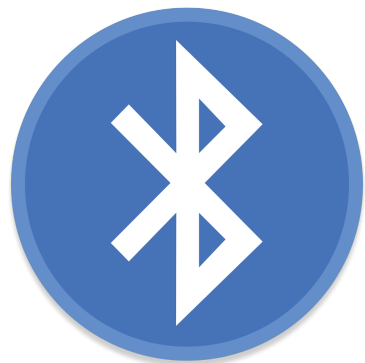
THE SMARTPHONE ADDS TO THE DELAY

To save phone battery, the operating system periodically shuts down the Bluetooth antenna which misses the beacon.



NEED A SAMPLE TO INCREASE ACCURACY

Most APIs, including the iBeacon service, seem to collect multiple readings before delivering a reading to the app. This is Ranging. Collecting that sample takes time.



RSSI
-78

RSSI
-62

RSSI
-72

RSSI
-69

RSSI
-12

=

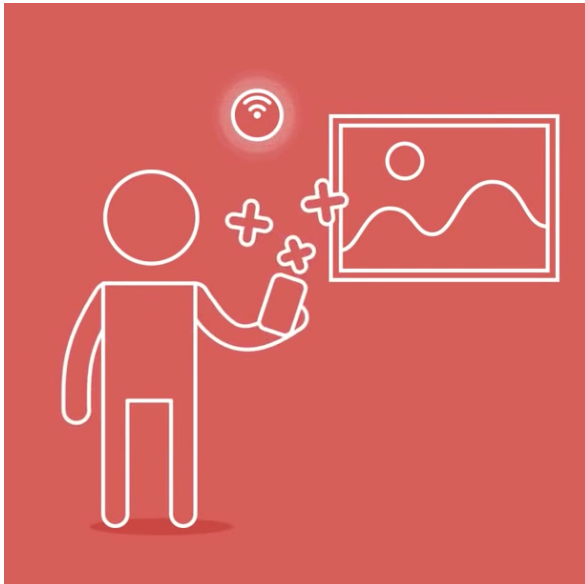


A large warehouse filled with stacks of lumber. The stacks are arranged in long, parallel rows, creating a sense of depth. A bright, white spotlight beam originates from the bottom center and points towards the far end of the aisle, illuminating the path. The lighting is dramatic, with the spotlight area being very bright and the surrounding areas being in shadow. The wood has a warm, brownish-orange hue.

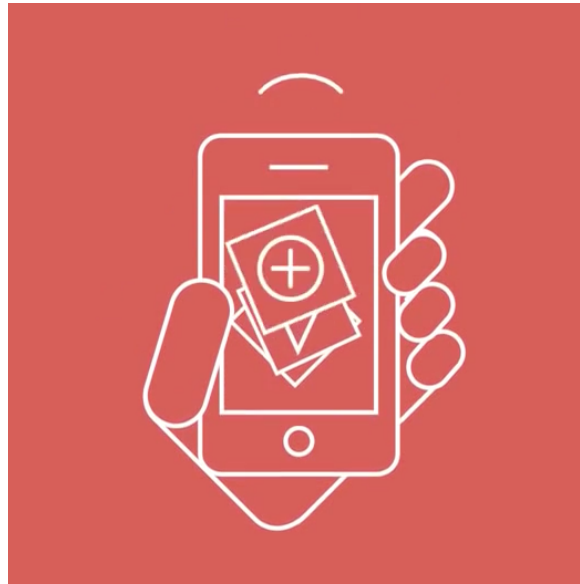
**WELCOME TO
THE
WAREHOUSE!**

REALITY 4 OF 7

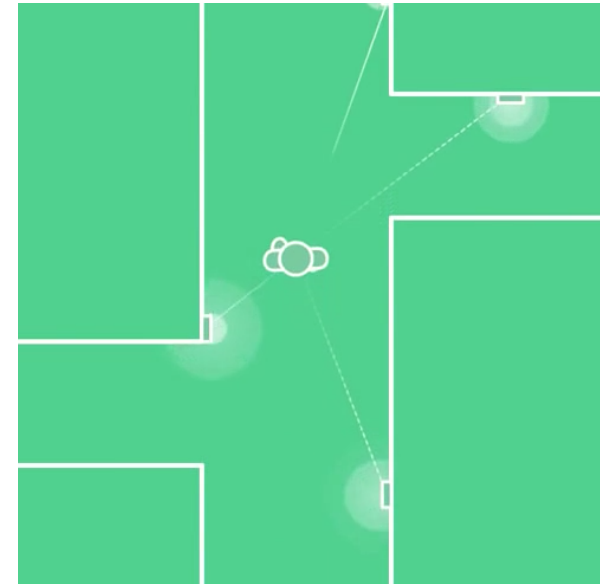
**THE REALLY MAGICAL
STUFF ISN'T THE BLE
BEACONS.**



INDOOR MAPPING DATA



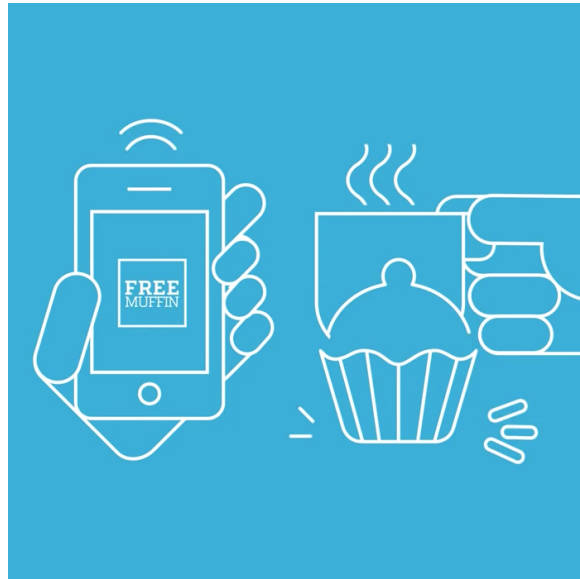
CONTENT MANAGEMENT SYSTEM



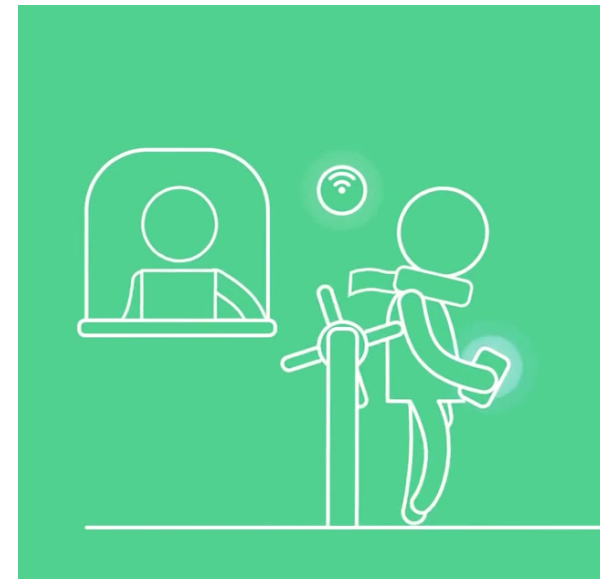
DIRECTION GENERATOR



POINT-OF-SALE INTEGRATION



LOYALTY MANAGEMENT SYSTEM

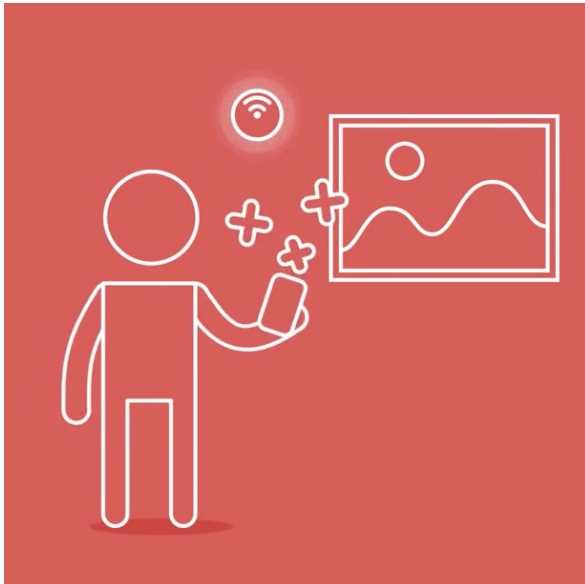


VENUE MANAGEMENT SYSTEM

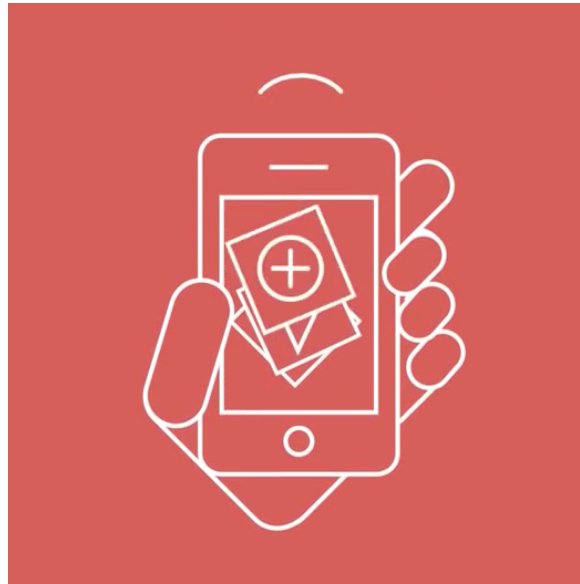
REALITY 5 OF 7

**YOU STILL NEED A
DATA CONNECTION TO
DO MOST STUFF.**

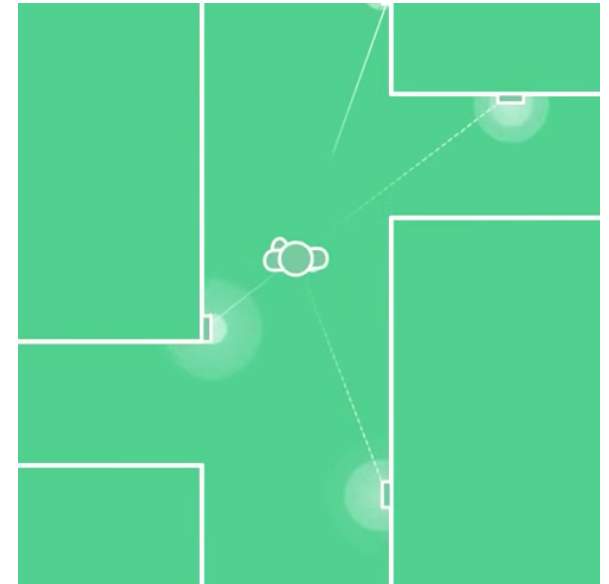
DATA CONNECTION



INDOOR MAPPING DATA



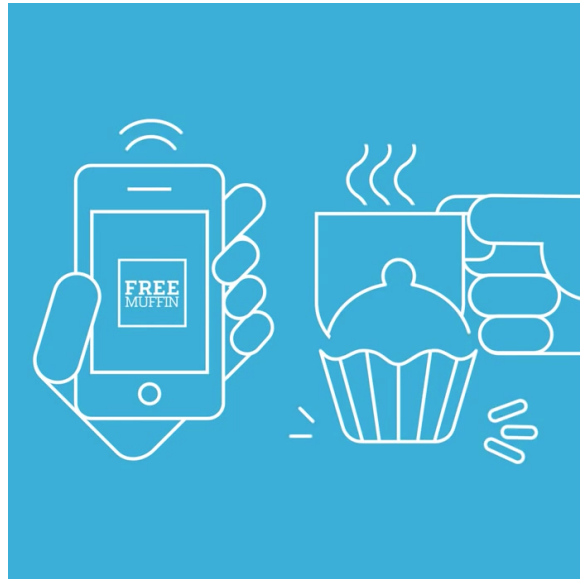
CONTENT MANAGEMENT SYSTEM



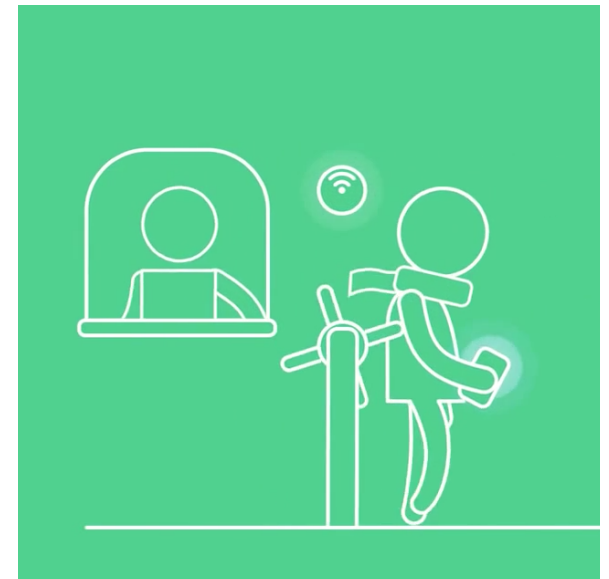
DIRECTION GENERATOR



POINT-OF-SALE INTEGRATION



LOYALTY MANAGEMENT SYSTEM



VENUE MANAGEMENT SYSTEM

REALITY 6 OF 7

**DON'T EXPECT MUCH
WHEN THE PHONE IS
IN YOUR POCKET.**

LOCKED IPHONE ONLY RECOGNIZES IBEACON

After Apple released the iOS7.1 update it, using Core Bluetooth to monitor regions when the phone is locked was no longer available.

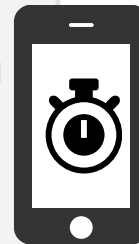
iPhones will only recognize BLE beacons using iBeacon to wake a phone up while locked.



NOT A BIG DEAL IF IT WORKS

A LOCKED IPHONE WILL ONLY WAKE FOR SECONDS

A locked phone will wake long enough to trigger a notification but not long enough to determine a confident location or send significant data.

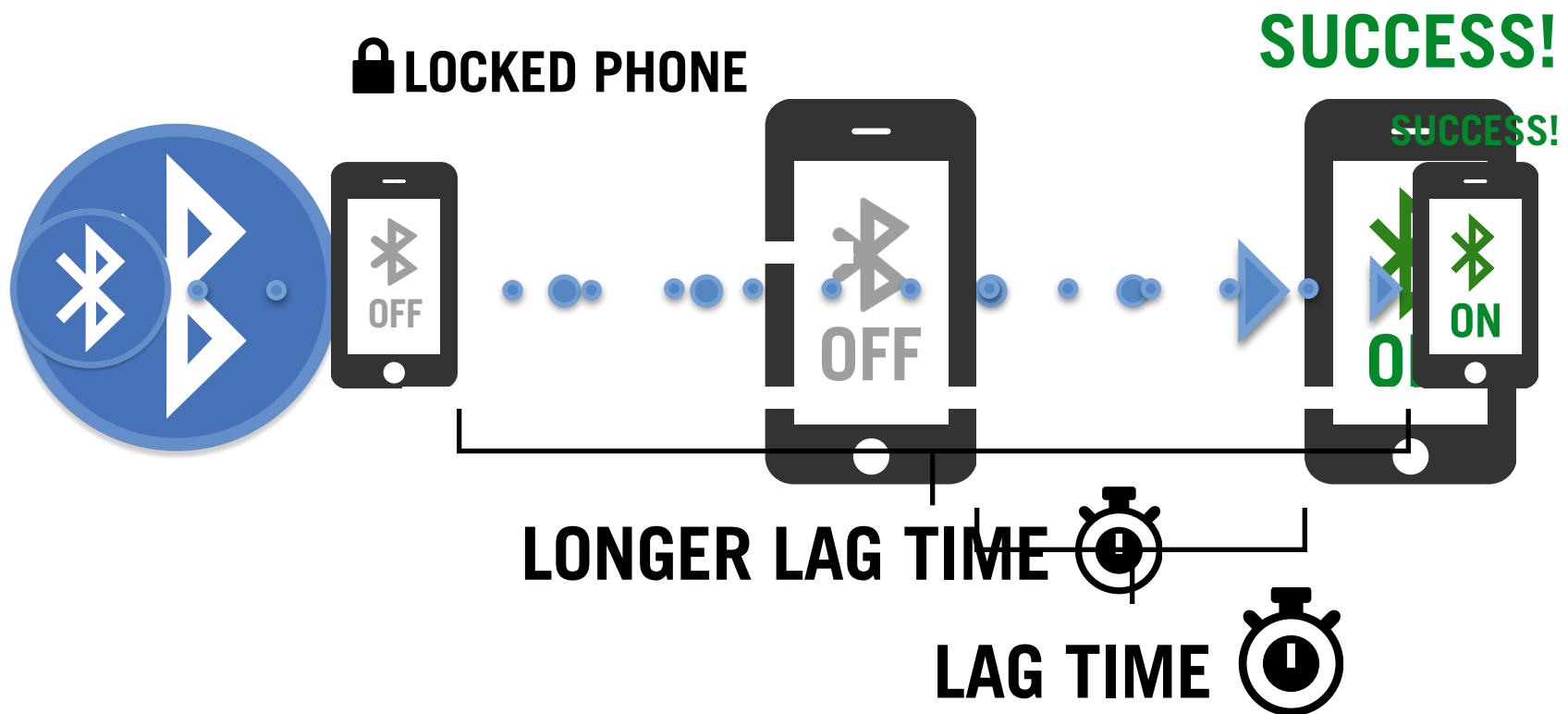


**I SEE AN IBEACON.
APP, YOU HAVE 10 SEC.**

BROADCAST
RANGE

BLUETOOTH TURNS ON LESS FREQUENTLY WHILE LOCKED

There is a greater delay between an unlocked phone and a locked phone recognizing a beacon.



LOCKED IPHONES CAN'T MEASURE PROXIMITY

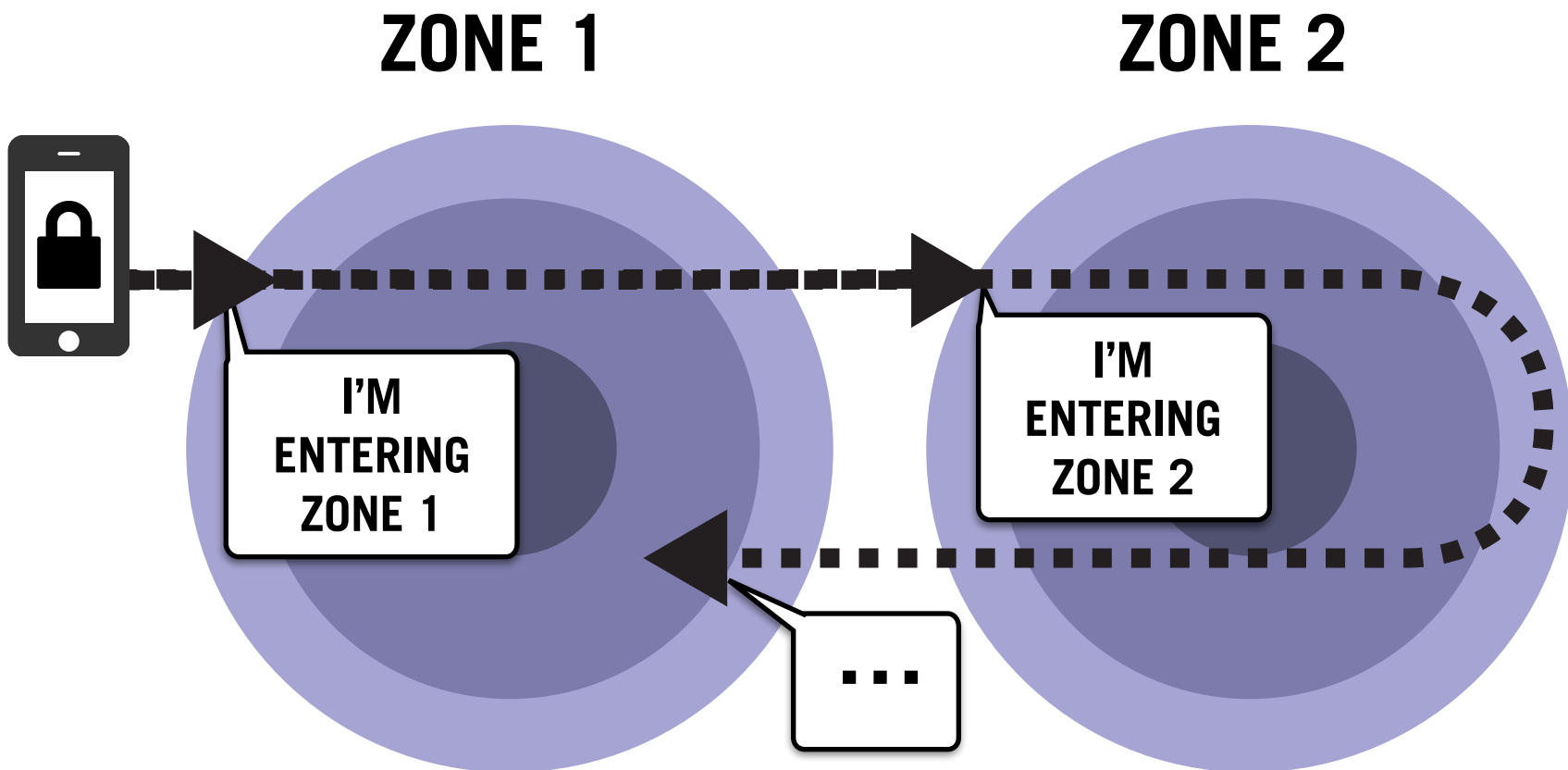
A locked iPhone can range so it can not know if its really close or at the edge of a beacon's transmission.

It only knows it entered into a broadcast range.



LOCKED IPHONES ONLY SEE IBEACONS ONCE

Within a certain period of time, if a locked phone sees the same beacon, it will ignore it.



REALITY 7 OF 7

**ALL OF THIS IS AT THE
WHIM OF THE PHONE
MANUFACTURES**

APPLE & GOOGLE HAVE THEIR OWN ROADMAPS

By including 3rd party devices in our experience, we can be affected by their product agendas.

EXAMPLES

- **Apple** is requiring greater compliance
 - Forcing iBeacons for locked devices
 - Limiting access to Bluetooth antenna
- **Android** phones are possibly becoming less reactive
 - New phones only sampling a portion of BLE beacon signals to save battery.
 - One estimate shows the Moto G decodes 25-33 of every 100 signals.*



WOW.

SO...

ARE YOU SAYING DON'T
USE BLE BEACONS?

NO.

**BLE BEACONS ARE A
GREAT TOOL
FOR THE RIGHT JOB.**



CONSIDERATIONS FOR USING BLE BEACONS

**BEACONS ON THEIR
OWN CAN DELIVER
IMPACT***

*** JUST SET THE RIGHT EXPECTATION**

BEACONS ARE AWESOME FOR PROXIMITY

THINK “NEARBY”

“You are near Men’s Boots”



NOT SPECIFICS

“You are looking at these shoes.”



SET EXPECTATIONS OF REACTION TIME

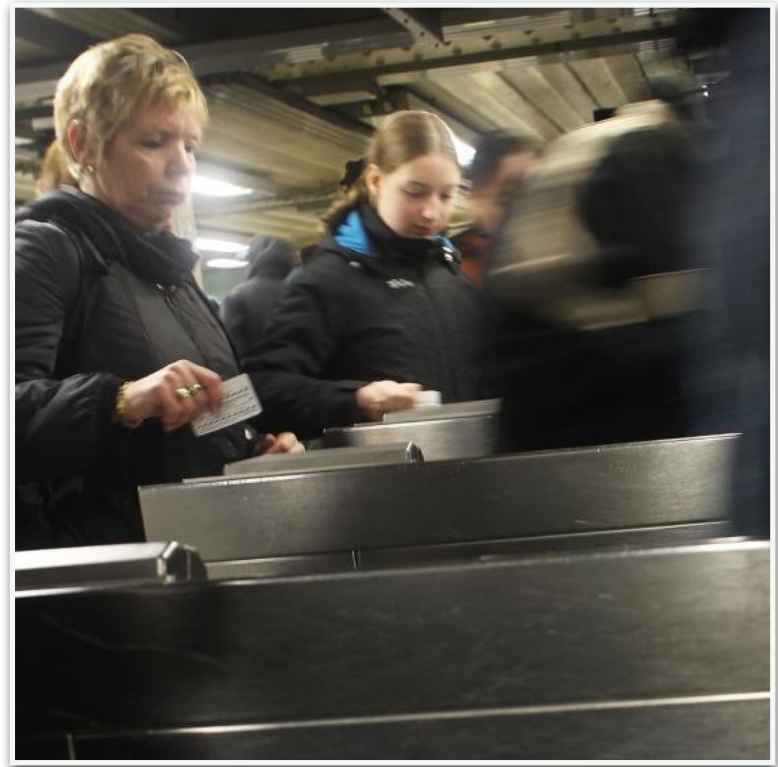
MANY SECONDS

“Looks like you are browsing...”



NOT MILLISECONDS

“Pay Now”



THINK OF USING BEACONS FOR...

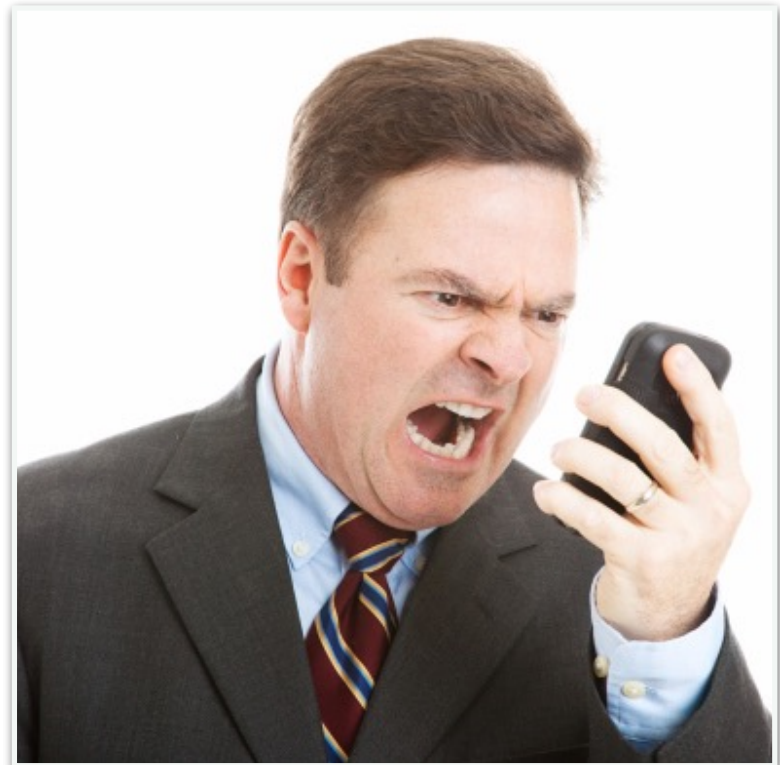
SUPPORTIVE DELIGHT

“Well, thats cool!”



NOT CRITICAL PATH

“Work NOW!”



**EVEN BETTER, USE
BEACONS AS ONE OF
MULTIPLE SOLUTIONS***

*** THINK EXPERIENCE FIRST. THEN
WHAT TECHNOLOGY WILL SUPPORT IT.**

CONSIDER MULTIPLE SOLUTIONS



GPS

for fairly precise location outdoors



BLE

for what you are nearby



NFC/RFID

for precise trigger of transaction
(the last few inches) *

APPLE NEEDS MULTIPLE SOLUTIONS

2013

Announcement of iBeacons causes a stir around NFC

The image displays two overlapping screenshots of news articles. The background article is from a social media or blog platform, featuring a header with 'Follow' and 'Reblog' buttons. The text reads: 'apple / nfc / iphone 5s', 'With iBeacon, Apple is going to dump on NFC', and 'internet of thin'. It also shows '182 Comments' and social media sharing icons. The foreground article is from Business Insider, dated September 12, 2013, at 3:56 PM. The headline is 'Apple's New iBeacon May Spell The End Of NFC Technology'. The article has 9,552 views and 1 comment. The Business Insider navigation bar includes links for Tech, Finance, Politics, Strategy, and Life. At the bottom, there are buttons for Facebook, LinkedIn, Twitter, Google+, and a print icon.

om + Follow ↗ Reblog

apple / nfc / iphone 5s

With iBeacon, Apple is going to
dump on NFC
internet of thin

Guest Writer

182 Comments

BUSINESS INSIDER Tech Finance Politics Strategy Life

Apple's New iBeacon May Spell The End Of NFC Technology

SEP. 12, 2013, 3:56 PM 9,552 1

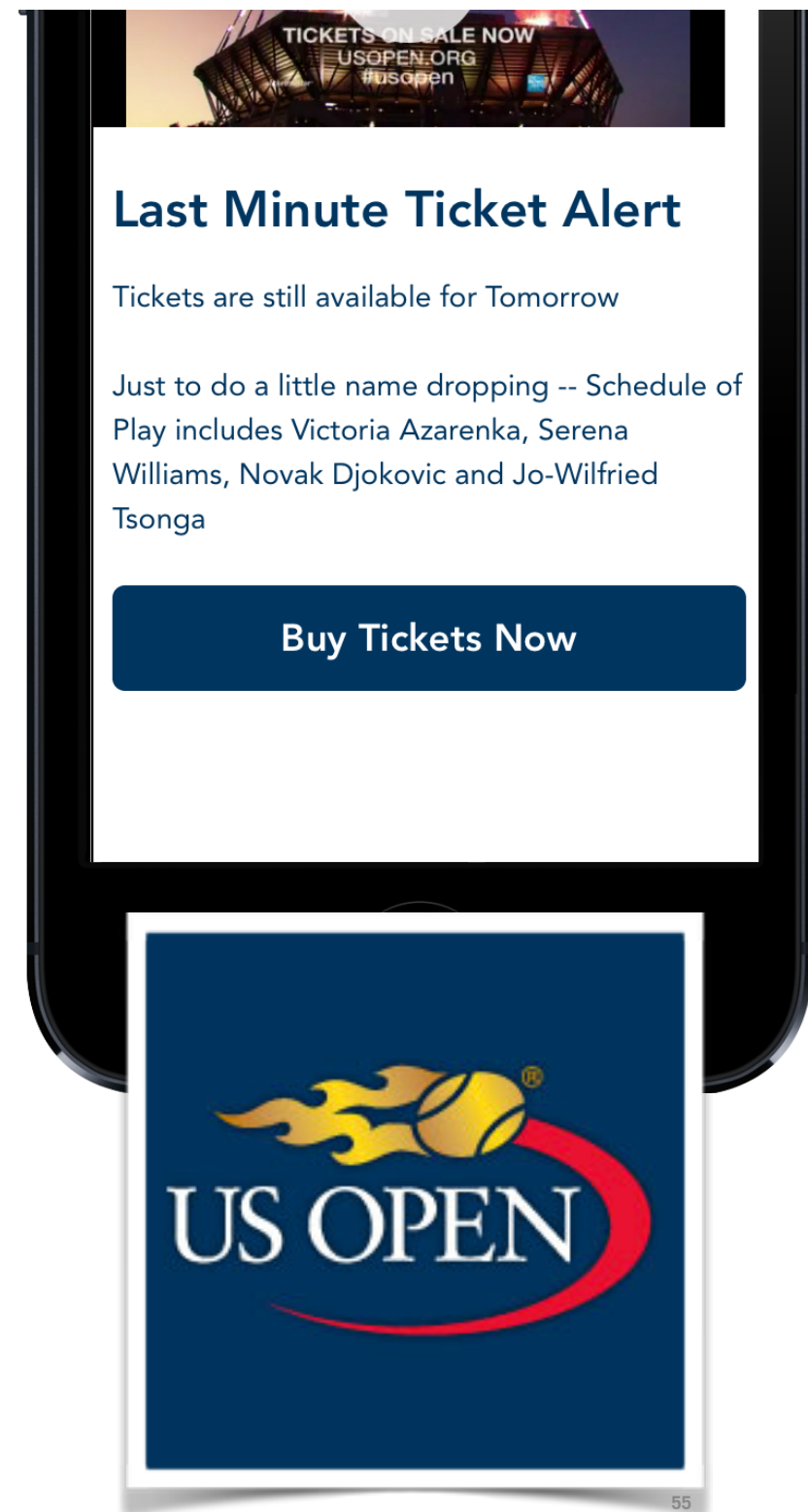
FACEBOOK LINKEDIN TWITTER GOOGLE+ PRINT

COMBINATION CASE STUDY

2014 US TENNIS OPEN

MOBILE MOMENTS

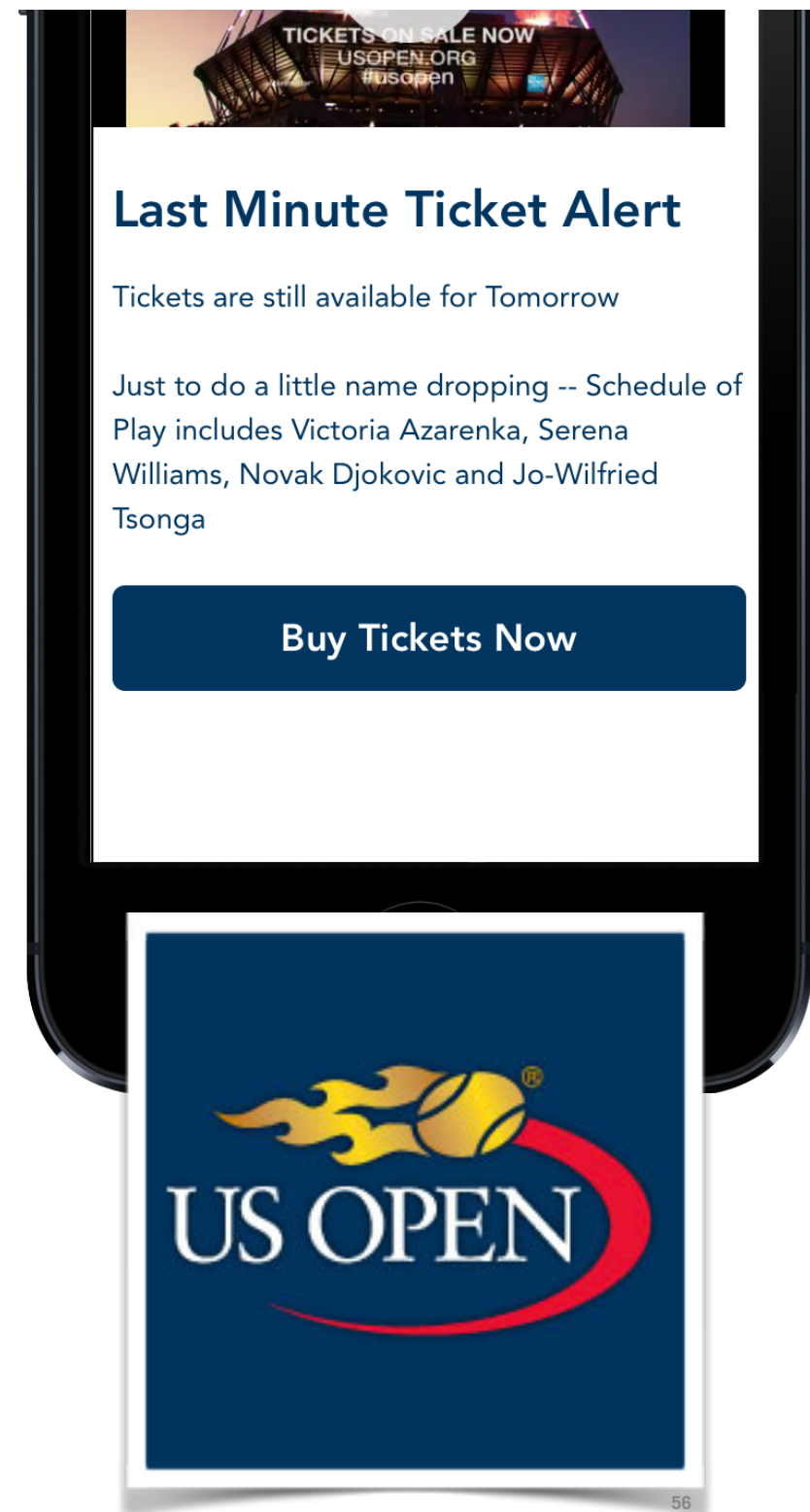
- First time visitor orientation
- Daily event updates
- Special deals
- Last minute ticket sales



COMBINATION CASE STUDY

2014 US TENNIS OPEN

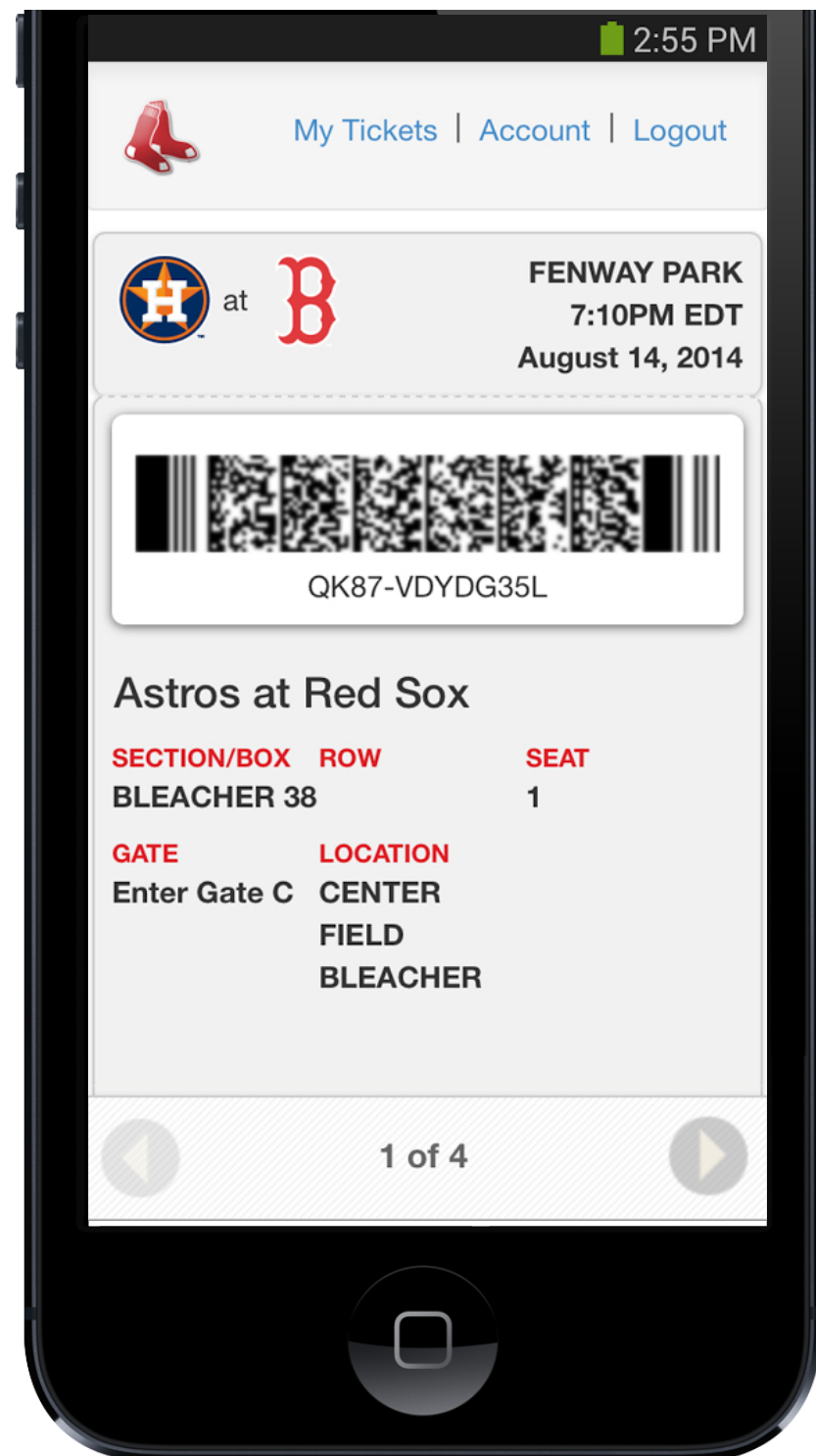
- **Geofencing** to understand exterior location
- **iBeacons** to understand more granular proximity
- **Push Notifications** delivered by UrbanAirship



COMBINATION CASE STUDY

MLB “STADIUM” EXPERIENCE

- Bar Scanners to enter
- Read Beacons
 - Lead to your seat
 - Coupons near stores
 - Message you about section details (lines for bathroom and food)
- Your phone as a Beacon
 - Food vendor finds you
- NFC to transact



FINAL THOUGHT...

COMING SOON INDOOR POSITIONING

Both Apple, Google, and others are developing this as a combination service and product.

- **Service:** A 3rd party will map the space to get it as accurate as possible
- **Product:** Using a combination of special hardware (Motion processors & Sensors), frameworks (CoreLocation), and signals (WiFi, BlueTooth, GPS, Cell)

CURRENTLY IN BETA

FINAL THOUGHT...

COMING SOON INDOOR POSITIONING

APPLE'S TEST AT CALIFORNIA ACADEMY OF SCIENCES



IN SUMMARY

The big take-aways that we learned are:

- 1 Reaffirmed to not believe everything you see in speculative videos and blog posts. **TEST. TEST. TEST.**
- 2 BLE beacons are a great tool for the right job.
EXPERIENCES WITH GENERAL PROXIMITY NEEDS.
- 3 The best experiences often need more than BLE beacons can provide on their own.
THINK OF BEACONS AS ONE PART OF A LARGER SYSTEM.

THANK YOU!

QUESTIONS?

Contact me

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 @JFDONOHUE

 JFDONOHUE