Introduction to Bluetooth Beacons

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Bluetooth Beacons

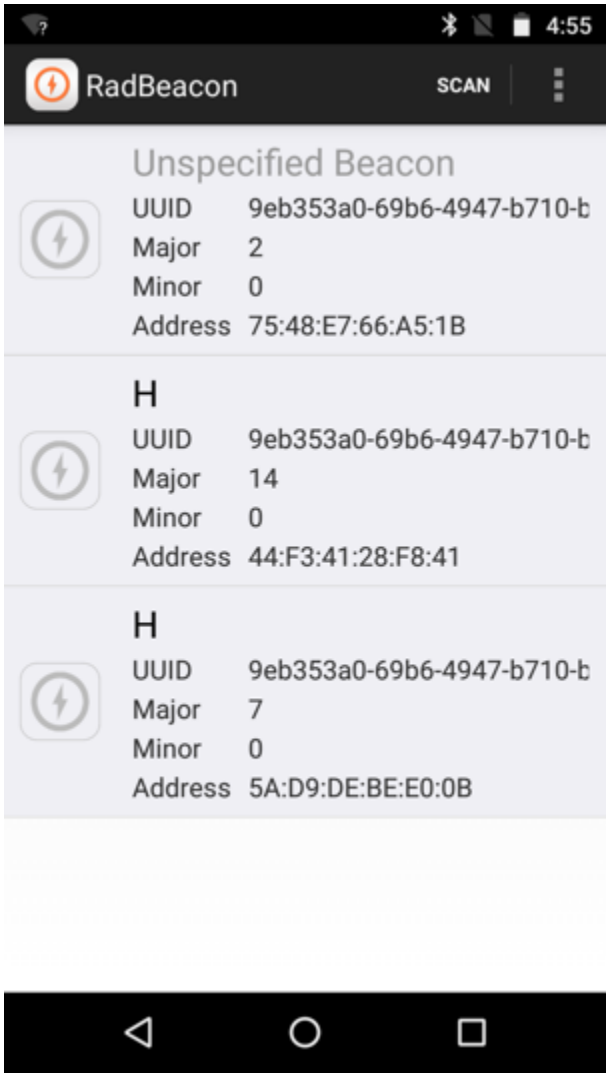
- Based on Bluetooth 4.0 Low Energy spec
  - One-way communication
- Send out messages n times per second
  - "HEY! I'm over here!"
- In 2011, Australian company Daelibs made the first BTLE beacons for shopping centers/malls
  - No one really knew what to do with it

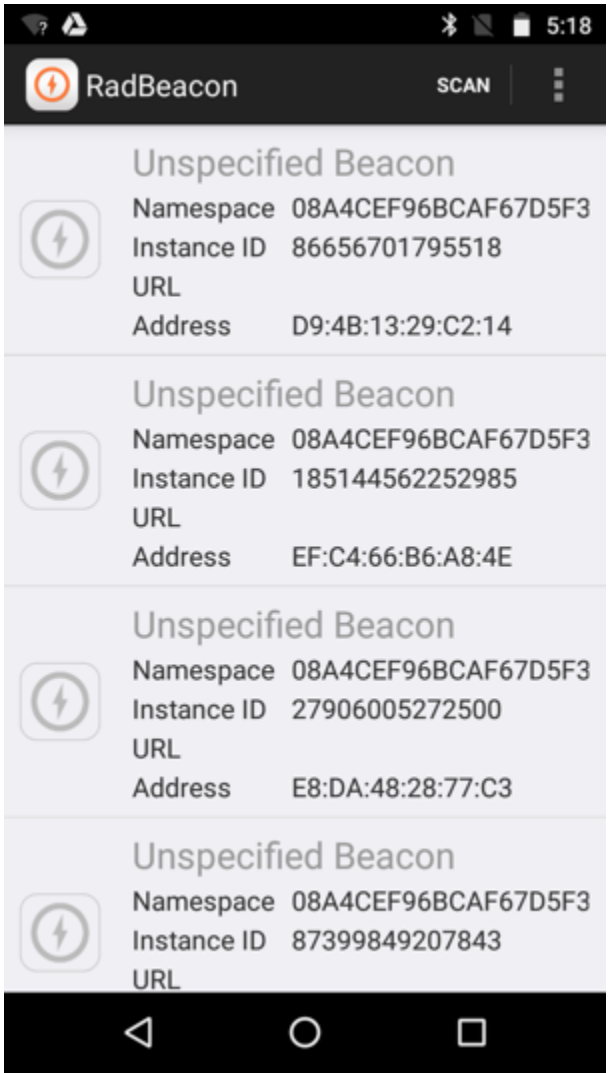
Where are we using Beacons?

- Advertising
  - Draw in proximal customers with coupons and sales
- Pushing applications
  - CVS uses beacons to push their photo app
- Parking garage/meter
  - Check the car in on entrance
  - Pay the meter using your phone

macy's

OLD NAVY





How Beacons REALLY work

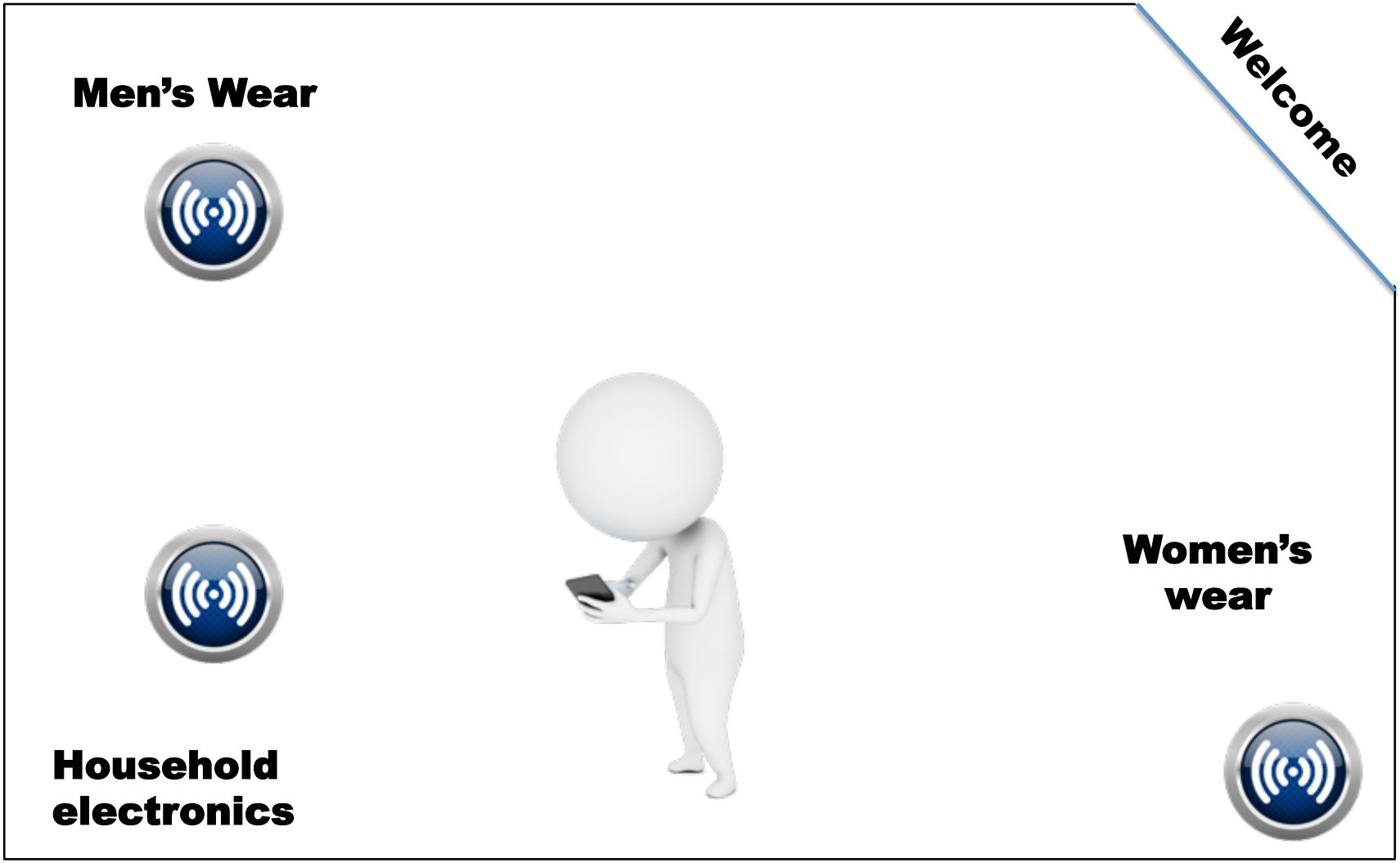
- They don't actually DO anything
  - Chirp "HI! I'm here!"
- GENERALLY, you need an app on your phone to interact with the beacon/service
- Use chirp to determine proximity
- Beacons are basically QR codes over the air

Location Vs Proximity

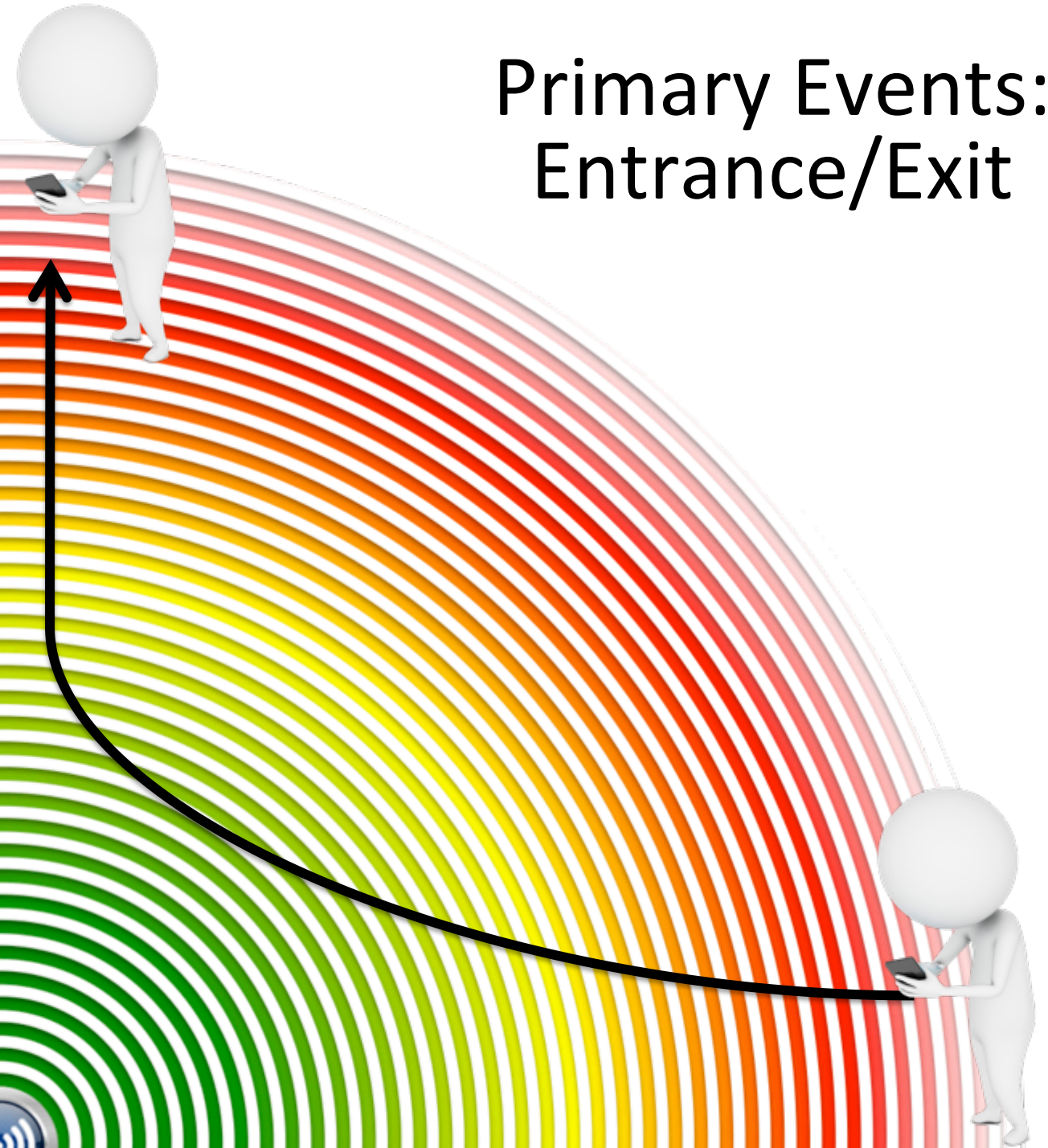
Location tells you where you ARE

Location Vs Proximity

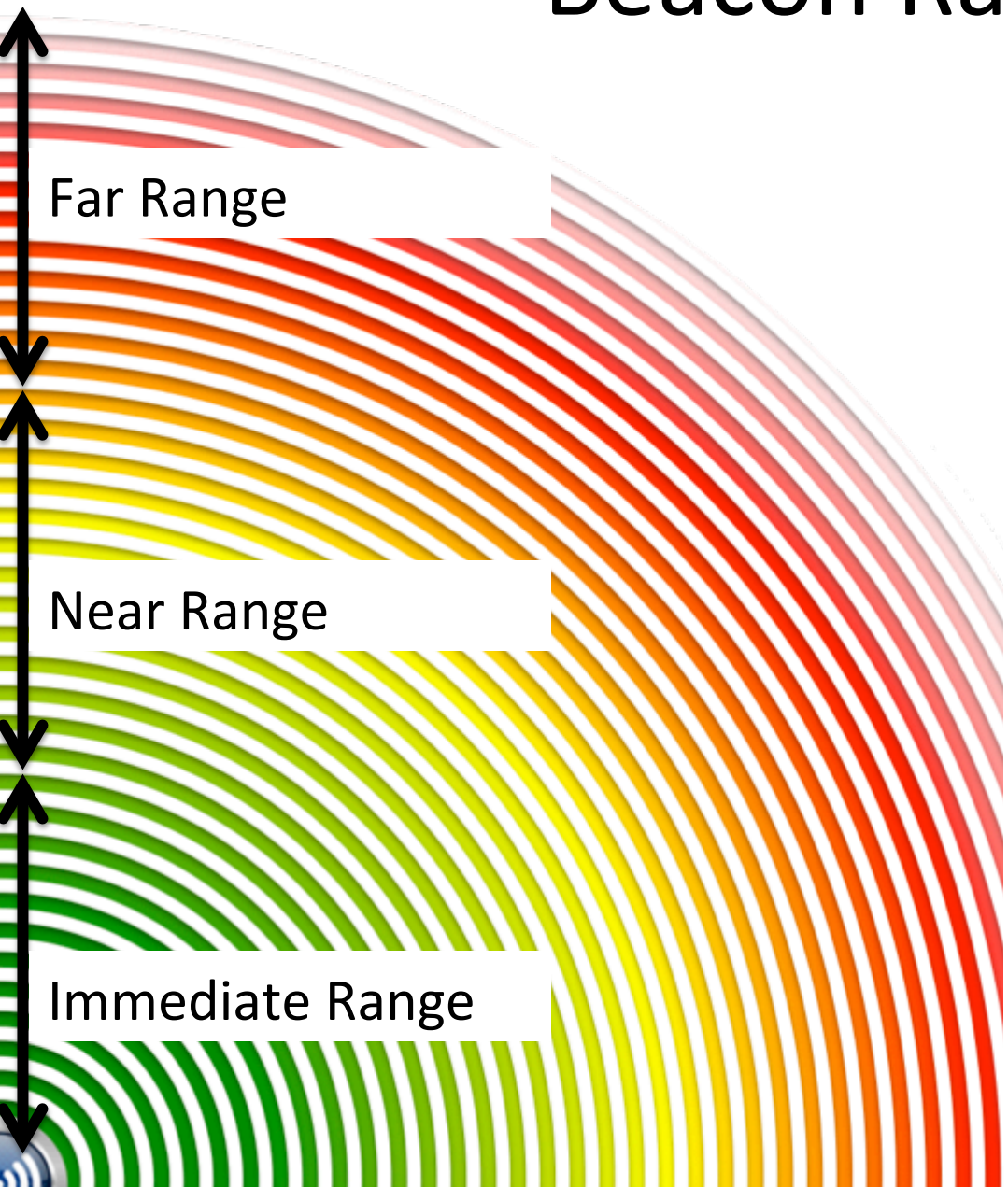
Proximity tells you to what you are close



Primary Events: Entrance/Exit



Beacon Ranging



- You normally don't look at EXACT distance
- In fact, you don't really look at distance at all!
- Range is based on signal strength

iBeacon

- “Developed” by Apple
- Recommended to advertise or chirp every 100 ms (ten times a second)
- Battery life can range from a few months to a couple years, depending on the advertise rate and battery used.
- Normally has a range of around 30 – 50 meters

Exposed iBeacon Payload

UUID	16 Bytes This is the identifier for the beacon. This field may not be customizable EXAMPLE: A5BF829E-1AD0-4F09-AD90-EDA5FF6EB334
MAJOR	2 Bytes Often used to denote the store location, such as the Austin, TX store, or store number 1234 EXAMPLE: 1234
MINOR	2 Bytes Often used to denote the section within the store such as Hardware, men's, women's, etc… EXAMPE: 1234
MEASURED POWER	1 Byte Used for ranging. This stores the value transmission power at 1 meter away from the beacon. Uses a two's complement EXAMPLE: 211 / 0xD3 (which means -45 db)

iBeacon Security

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Eddystone

- Developed by Google
- UID - Can send UID (similar to iBeacon)
- URL - Can send URL (Physical Web)
- TLM - Can send telemetric data (power levels, temp, other sensor data)

- Can use Google Services to install applications or open android apps

Exposed Eddystone UID Payload

UID	Namespace 10 Bytes Could be used to denote the company/service provider LOOKS like 20 bytes because Hex is two digits Can be created from UUID if you want to use Eddystone & iBeacon
	Instance 6 Bytes Used to denote the specific beacon, or store location
	UUID combined 16 Bytes 0123456789ABCDEF
MEASURED POWER	1 Byte Used for ranging. This stores the value transmission power at 0 meters away from the beacon. EXAMPLE: 0x12 = 18dBm

Eddystone – Physical Web

- Advertises a URL instead of a UID
- Non-intrusive notifications
  - You need to have an app RUNNING or be actively scanning for beacons to see the physical pages
    - Google notifications
    - iOS Today page
- Essentially, a Bluetooth QR code

Exposed Eddystone URL Payload

URL	URL Schema 2 Bytes EXAMPLE: 0x01 =“ HTTPS://www. “
	URL itself 17 Bytes Used to denote the specific beacon, or store location EXAMPLE: “goo.gl/URLhere”
MEASURED POWER	1 Byte Used for ranging. This stores the value transmission power at 0 meters away from the beacon. EXAMPLE: 0x12 = 18dBm From Google: Note to developers: the best way to determine the precise value to put into this field is to measure the actual output of your beacon from 1 meter away and then add 41dBm to that. 41dBm is the signal loss that occurs over 1 meter.

Eddystone Security

- Eddystone URL – URLs must resolve to HTTPS
- Nearby API calls (app intents, using UUID to link to URLS) are managed via HTTPS connection to google services
- EID: Ephemeral ID
  - The UID changes regularly based on API key
  - Application must use the same key

Beacon Apps

- Must be ACTIVELY listening for beacons
  - For Eddystone-URL YOU need to be actively looking!
- Once the Beacon is detected, the application does… something.
- Cross-domain/Cross-protocol calls are an issue! You must make HTTPS calls

App Considerations

- What will your triggering event be?
  - Do you want to set off an event when the beacon is FOUND (entrance event)
  - Or do you want to signal the user when LEAVING a region (exit event)
- Will you use iBeacon or Eddystone?
  - WHICH Eddystone!?

Beacon Considerations

- iBeacon vs Eddystone
  - WHICH Eddystone?
- How will you segment your beacon fleet
  - Major/Minor split
  - Namespace/Instance split
- How far apart do you need the beacons to be?
  - Too much overlap can cause app confusion

Beacon Considerations

- Would I just be better off using a QR code?
  - Doesn't require any power
  - Doesn't REALLY require any maintenance (keep the QR Code clean)
  - Can be used to carry a URL or a UUID
  - No attenuation issues!

Reference Sites

- https://google.github.io/physical-web/
  - All about Google's Physical Web beacons
- https://github.com/google/eddystone
  - Eddystone specs
- https://youtu.be/Acdu2ZdBaZE?t=28m8s
  - Introduction to "Google Nearby"

Reference Sites

- https://evothings.com/penn-state-university-taking-attendance-using-beacons/
  - Penn State attendance example
- https://evothings.com/doc/starter-guides/eddystone-starter-guide.html
  - Evothings guide to Eddystone
- https://developer.apple.com/ibeacon/
  - Apple's iBeacon site

An Introduction to Bluetooth Beacons

You can find the example files at GitHub:
https://github.com/aa-altieri/connect.tech-Sams_example

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