IoT: Impact of the Physical Web and Beacons

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The Physical Web

- Everyday objects with ability to interact with the Internet, mobile devices
  - Smart TVs, Refrigerators, Microwaves etc.
  - Provides information, status etc.
- Bluetooth Low Energy (BLE)
  - New protocol to transmit information
  - Low power, short distance
- Beacons!
  - Many Vendors: Estimote, Radius Networks, BKON
What is a Beacon?!

• Small transmitter device
  – Sold by many small/large companies
  – Uses Bluetooth Low Energy (BLE)
  – Uses batteries (cell, AAA etc.)
  – Long battery life (years)
  – Price ranges from $10-$30
  – Advertises itself on a regular basis
  – Recognized by mobile phone apps
  – Transmits when a receiver is close (proximity)
  – Small size data transfers
  – Unique Beacon ID, can be managed remotely
What are the protocols?

• Apple – iBeacon Protocol
  – Original iBeacon protocol
  – Transmits Beacon UID and Short Text

• Google – Eddystone Protocol
  – UID – Unique ID + Text
  – URL – Unique ID + URL + Text
  – TLM – Telemetry Data, for management
  – EID – Ephemeral ID, secure access (new!)

• Smartphone – iOS and Android
So, how does it work?

• Beacon Advertisement
  – Regular transmissions of UID etc.

• Receiver in Proximity (Range)
  – Typically a smartphone with app
  – Many vendors have beacon apps
  – Google Play: The Physical Web
  – iTunes: The Physical Web

• Beacon Transmits Data
  – Ex. Eddystone URL resolves URL on mobile app
IBKS 105

The most flexible coin cell battery beacon.

- Officially the first beacon compatible with iBeacon™ and Eddystone™ (UID, URL, TLM, EID) at the same time.
- IBKS 105 is cost efficient and reliable, the main keys for your beacon deployments.
- From 30 to 40 months of battery lifetime (CR2477) advertising once per second.

All the parameters of this product can be modified. Please check out our ‘IBKS Config Tool’ app, available for iOS and Android.

**SELECT YOUR KIT:**

- 3 beacons (kit) - $50.00
- 5 beacons (kit) - $75.00

**OR BULK ORDER:**

Select quantity
estimote™ stickers
real-world context for your apps
Nearables Developer Kit
10 Bluetooth Low Energy Beacons
Edit Beacon

Beacon ID
xmrkGsr

Alias
My Beacon Name

Default URL
http://www.mobls.com/recreationwellness

Notes
This beacon is near the entrance, above the door and to the left of the exit sign.

Default Proximity
- Immediate
- Close
- Far
- Off

* Only users with the BKDN Browser app will currently benefit from your Proximity settings.

SAVE SETTINGS
CANCEL

Remove this Beacon ID

Edit Beacon

Beacon ID
xmrkGsr

Alias
Recreation and Wellness

Default URL
http://www.mobls.com/recreationwellness

Notes
This beacon is near the entrance, above the door and to the left of the exit sign.

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SAVE SETTINGS
CANCEL
A platform for marking up the world to make your apps and devices work smarter by providing timely, contextual information.

Mark up the world using beacons

Give your users better location and proximity experiences by providing a strong context signal for their devices in the form of Bluetooth low energy (BLE) beacons with Eddystone, the open beacon format from Google.

The Google beacon platform enables you to manage your beacons remotely, integrate with Google services and help users' devices to discover content and functionality across Android, native apps and the web.
The Physical Web is an open approach to enable quick and seamless interactions with physical objects and locations.
Beacon Tools

Google LLC  Tools

Everyone

This app is compatible with some of your devices.

Installed
Beacon Tools
By Google, Inc.
This app is only available on the App Store for iOS devices.

Description
Set up and manage Bluetooth Low Energy (BLE) beacons with the Google beacon platform. Beacon Tools lets you configure and register your beacons with your Google Cloud Platform project, and create small attachments for them enabling functionality in your apps or with Google apps and services.

Beacon Tools Support › Application License Agreement ›

What's New in Version 2.0
☞ Extensively updated user experience.
* Hardware configuration of compatible Eddystone beacons.
* Bug fixes.

iPhone Screenshots
Beacon Toy

Adrian Cretu  Tools

Everyone

Offers in-app purchases

⚠️ This app is compatible with some of your devices.
iBeacon

From welcoming people as they arrive at a sporting event to providing information about a nearby museum exhibit, iBeacon opens a new world of possibilities for location awareness, and countless opportunities for interactivity between iOS devices and iBeacon hardware.
OK, so what?

• Beacons provide proximity info
  – Beacons are not connected to the Internet
  – They provide "nearby" information
  – Receiver does [will] not need any app
    • Google in integrating beacon info in Android
    • Somewhat similar to searching for Wi-Fi
  – Beacons can be associated with objects
  – Or, locations, people, animals etc. etc.
  – Beacons = Physical things + Web
Issues and Concerns

• Remote Management
  – Locations need to be mapped
    • Somewhat similar to deployment of WAPs
  – Need to be managed
    • Weather, battery life, status
  – Transmittal URL information
    • Needs to be current and updated

• Costs
  – $10-$30 per beacon can get expensive
  – Time and cost for IT to manage beacons and content
More Issues and Concerns

• Current State of Beacon Security
  – Limited!

• Unauthorized Tracking
  – Any receiver can track a beacon UID and Location

• Forgery
  – Adversary can forge the advertisement UID

• Showrooming
  – Adversary can insert competing info in beacon data
Security Mitigation

- Google’s Eddystone Ephemeral ID
  - Every beacon has a private symmetric key
    - Known only to the owner of the beacon
  - Unique Beacon Ephemeral ID (EID)
    - Symmetric key + pseudo-random function of Beacon clock
  - Unique Beacon EID needs registration
    - Global online trusted resolver of Beacon IDs
    - Sharing permission policy allows other to connect
  - Receiver securely connects to a Beacon when...
    - Smartphone receives Beacon EID
    - Sends EID to the cloud/global resolver service
    - Cloud/global service matches EID with registered keys
Beacons on College Campus

• Guided tour of campus
  – Each major object on campus has a beacon!

• Classroom
  – Classroom beacon provides current status, schedule

• Cafeteria
  – Daily hours, specials, prices, other info.

• Stadium
  – Current scores, ticket information, events etc.

• Faculty Office
  – Office hours, appointment schedule etc.
<table>
<thead>
<tr>
<th>Case Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Retail</strong></td>
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<tr>
<td>Attract, engage and understand your customers. Deliver exact information, not mass messaging.</td>
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<tr>
<td><strong>Tours</strong></td>
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<tr>
<td>Provide visitors with customized guided tours, including food and entertainment ideas.</td>
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<tr>
<td><strong>Trade Shows</strong></td>
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<tr>
<td>Provide interactive maps, seamless check-in, attendance details and relevant schedule updates.</td>
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<td><strong>Healthcare</strong></td>
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<tr>
<td>Improve efficiency and generate data as proof of compliance. Engage families and staff relative to proximity.</td>
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<tr>
<td><strong>Real Estate</strong></td>
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<tr>
<td>Enrich house hunting experiences. Provide far greater detail, serve up listing content, boost realtor efficiency.</td>
</tr>
<tr>
<td><strong>Events</strong></td>
</tr>
<tr>
<td>Improve experience and increase engagement by analyzing traffic and making real-time campaign changes.</td>
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Case Studies

• Retail
  — Beacons identify various store locations
    • As customers approach, provides info, sales etc.

• Hospitals/Hotels
  — Beacons can identify a patient/guest, location info.

• Any Physical Location of Interest
  — Museum, Conventions, Stadiums, Tourist Location

• Education
  — Beacons can identify classroom info, cafeteria etc.
Conclusion

• Current Web
  – Cloud based
  – URL describes content in cloud
    • Related to people, places, things etc.

• Physical Web
  – Proximity content, near micro location
  – Context is a physical object and/or location
  – Does not require any app or downloads
  – IoT: Beacons allow Things to have Info via Internet