Beacon based interfaces

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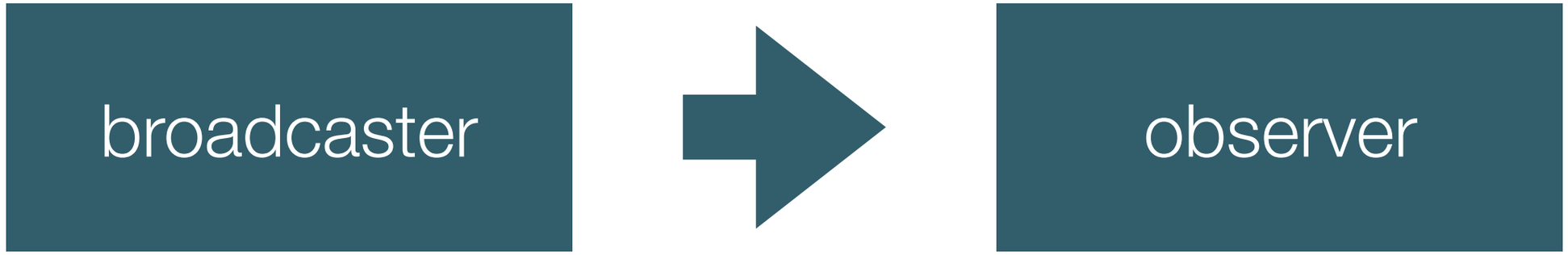
Bluetooth Low Energy (BLE, Bluetooth 4.0)

- reduced power consumption and cost wrt Bluetooth 3
- same or greater communication range (90m)
- 2.4GHz
- by 2018 more than 90 percent of Bluetooth-enabled smartphones will support Bluetooth Smart
- Bluetooth 5 will quadruple the range, double the speed, and provide an eight-fold increase in data broadcasting capacity of low energy Bluetooth transmissions compared to Bluetooth 4.x

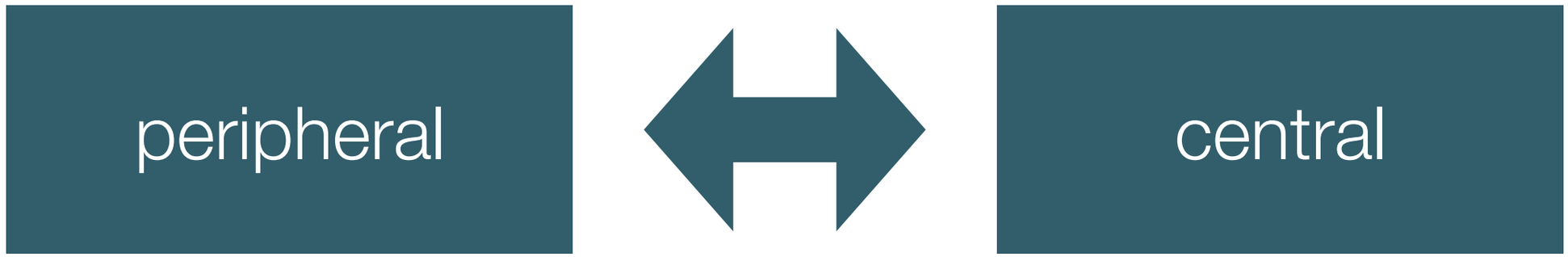
BLE advertising

- broadcast an ID and advertise services



- very few bytes of data available for other information

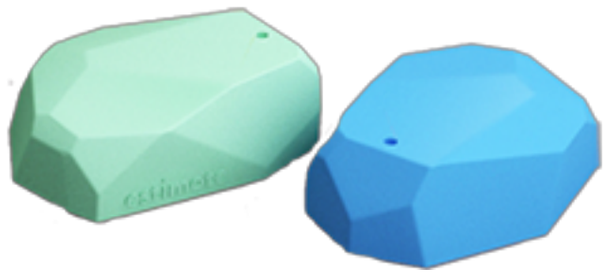
BLE connection

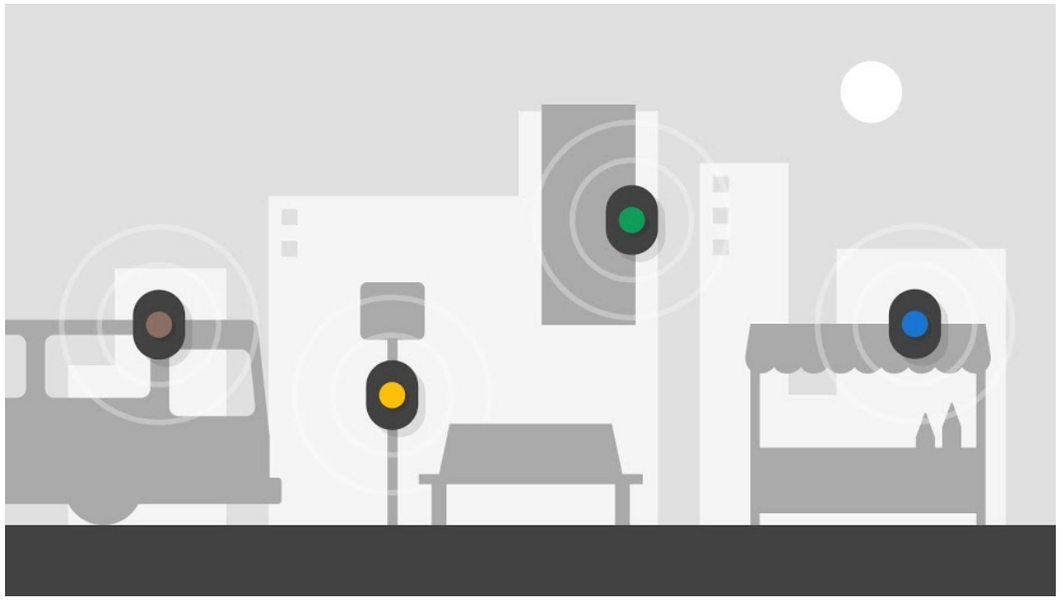


- Peripheral: server devices which provides data
- Central: client device which subscribes to advertised services and can read and write data

Beacons

- BLE acting as advertisers and peripheral





Beacons

- settings:
  - frequency
  - power (range)
  - advertisement data
- range: 5..70m
- battery duration: up to 3-5 years, depending on settings

iBeacon

- Apple
- UUID, Major, Minor
- apps can look up these values on a database and take action
- iOS can listen to 20 beacon IDs (regions)
- existing libraries support central and peripheral behaviour

Eddystone

- open Bluetooth 4.0 protocol from Google
- supported on Android and iOS
- Eddystone-UID and Eddystone-URL
- Physical Web
- telemetry packet Eddystone-TLM
- Eddystone-EID (security)

Region monitoring

- a region is the area where the beacon signal is received
- monitoring: entering/exiting region's range; performed by the operating system
- apps can subscribe for regions (observer)
- actions triggered only on entering and exiting (e.g. OS calls an observer app)
- works in the foreground, background, and even when the app is killed
- low power consumption on the smartphone

Ranging

- actions triggered based on proximity to a beacon
- works only in the foreground
- app can read all provided data
- including power settings and received power, to determine distance
- high battery consumption
- connection is possible

Integrated sensors

- temperature
- motion

Battery consumption

- beacon device: depends on frequency and power settings, integrated sensors, and on connections by centrals

- smartphone: depends on monitoring or ranging

Some main beacon producers

- www.estimote.com

- www.kontakt.io

Usage

Customer engagement

Indoor navigation

Location-based content

People monitoring

Access control

Asset tracking

And much more!

Presence

Proximity

Indoor location

Exercise (step 1 / 3)

- work in groups (multicultural)
- imagine a beacon application in one particular context:

Group	Context
1	home
2	car
3	shop
4	university
5	sport
6	office
7	hotel

- better define context, requirements, goals

Exercise (step 2 / 3)

- discuss embedding of beacons somewhere if needed
- chose components (other than beacons, like smartphones, computers, appliances, etc.)
- define workflow (write down)
- chose monitoring and/or ranging
- discuss battery consumption

Exercise (step 3 / 3)

- sketch interface:
  - chose appropriate interfaces: physical controls, lights, display, screen, sounds, voice, tangible, tactile, gestural, vision

- if there's an app: draw main views

Discussion