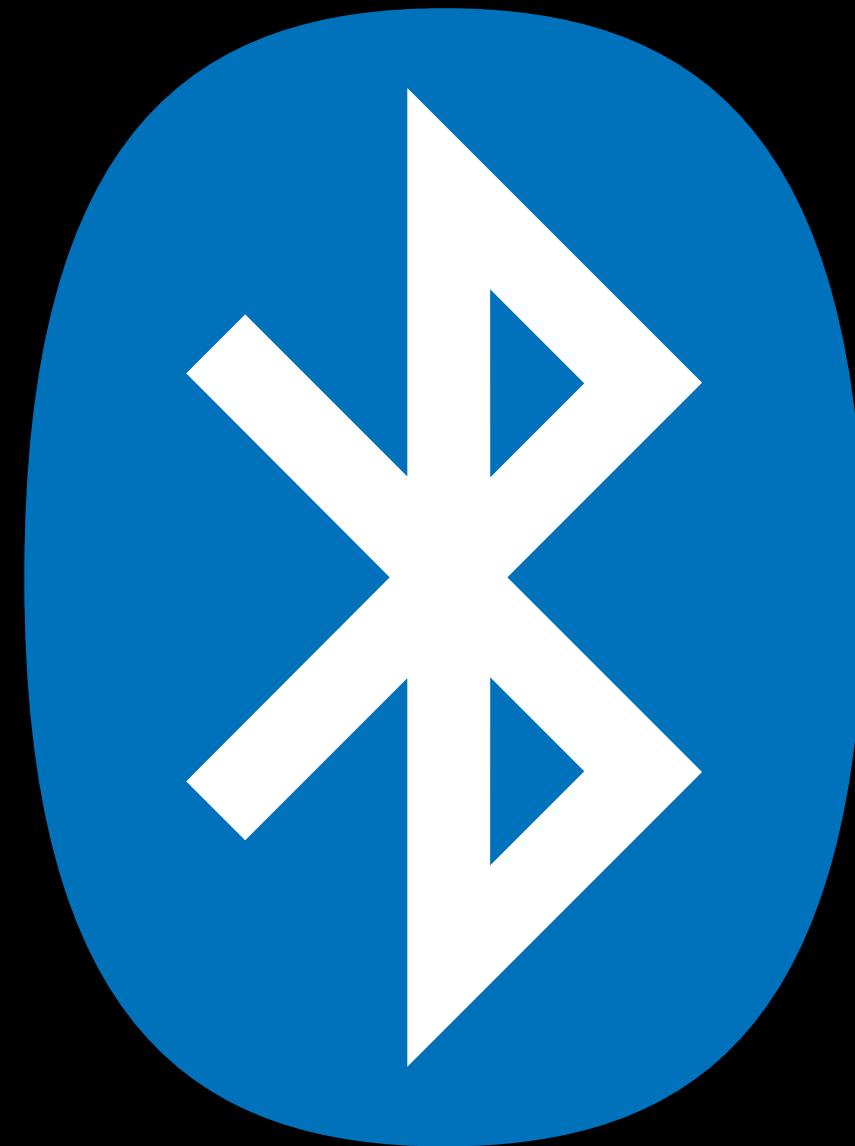


*fun with
bluetooth*



hallo ik ben @html5test

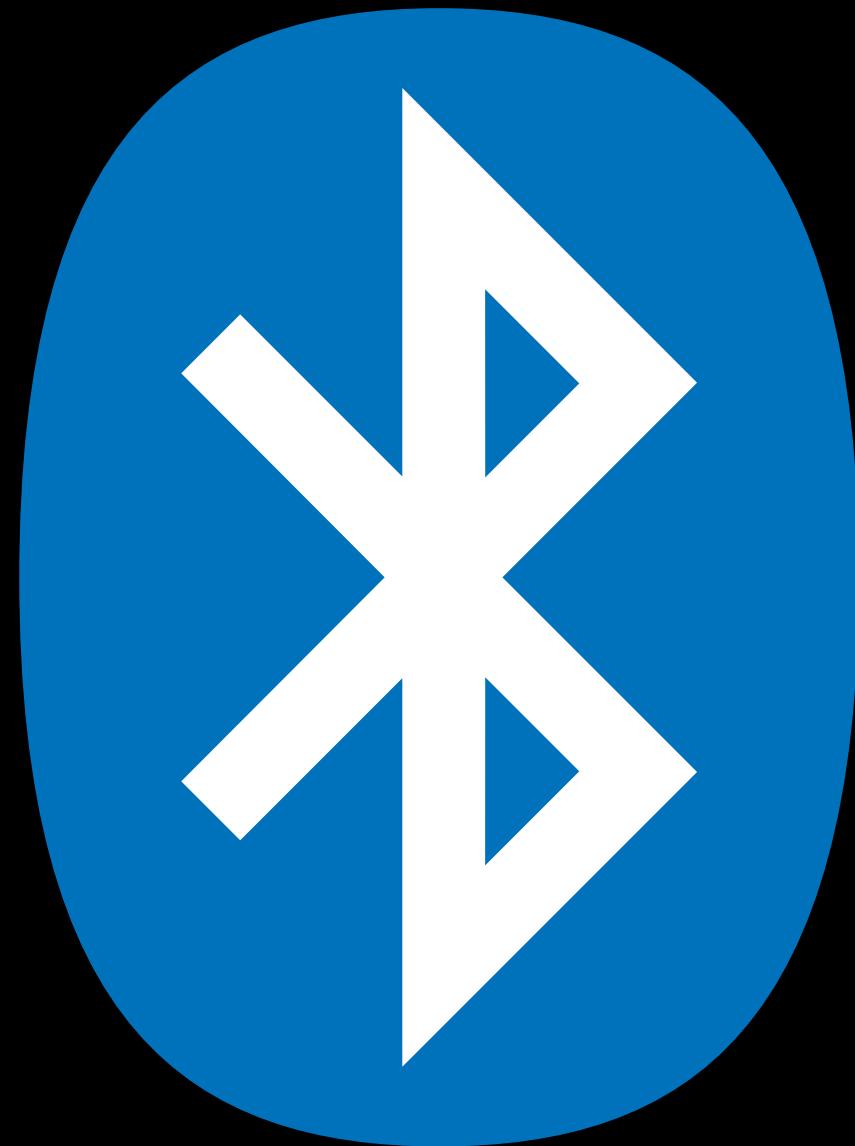




FRONTEERS

FRONTEERS CONFERENCE 3-4 OCTOBER 2019 AMSTERDAM

*fun with
bluetooth*

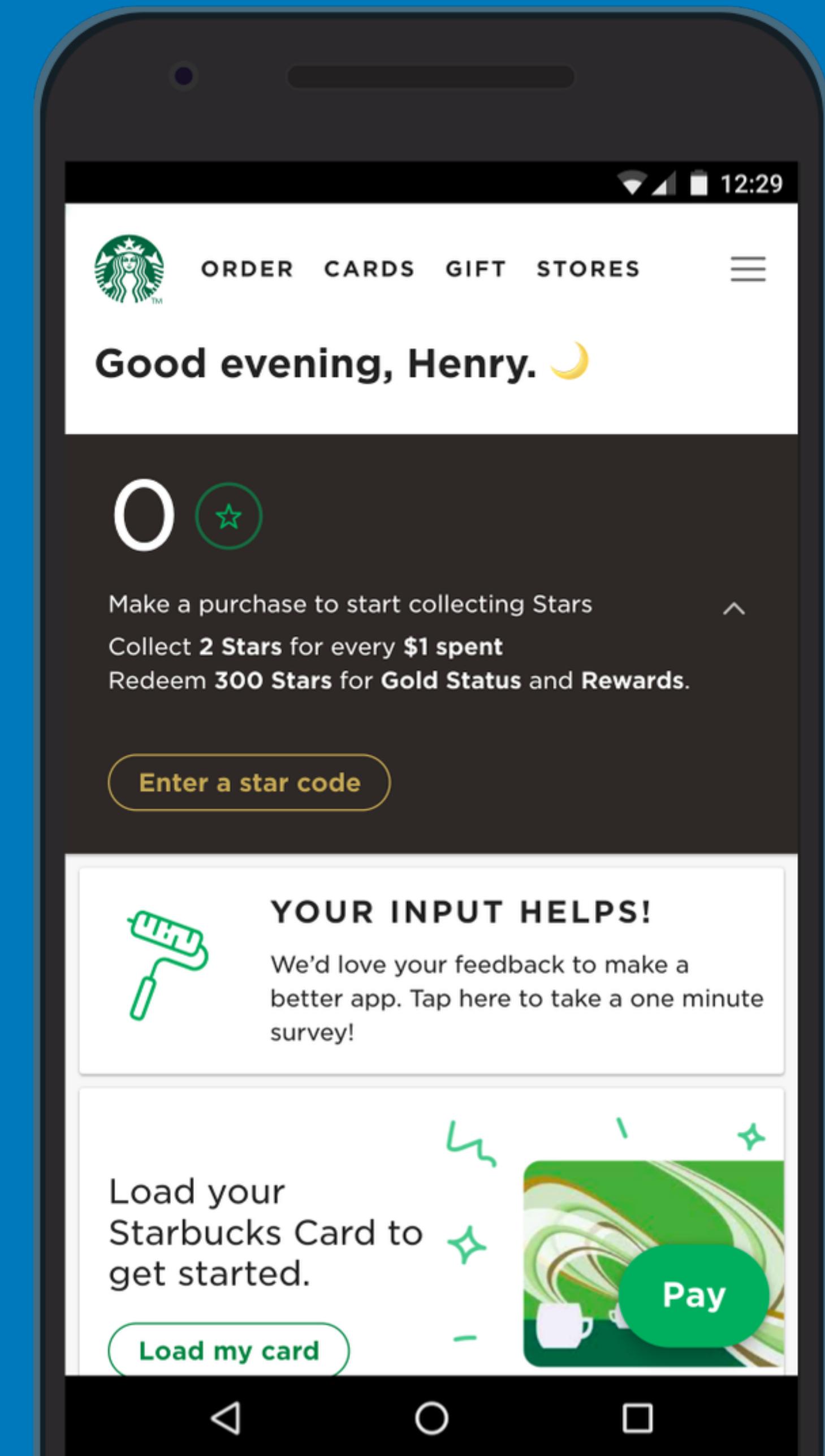


waarom?

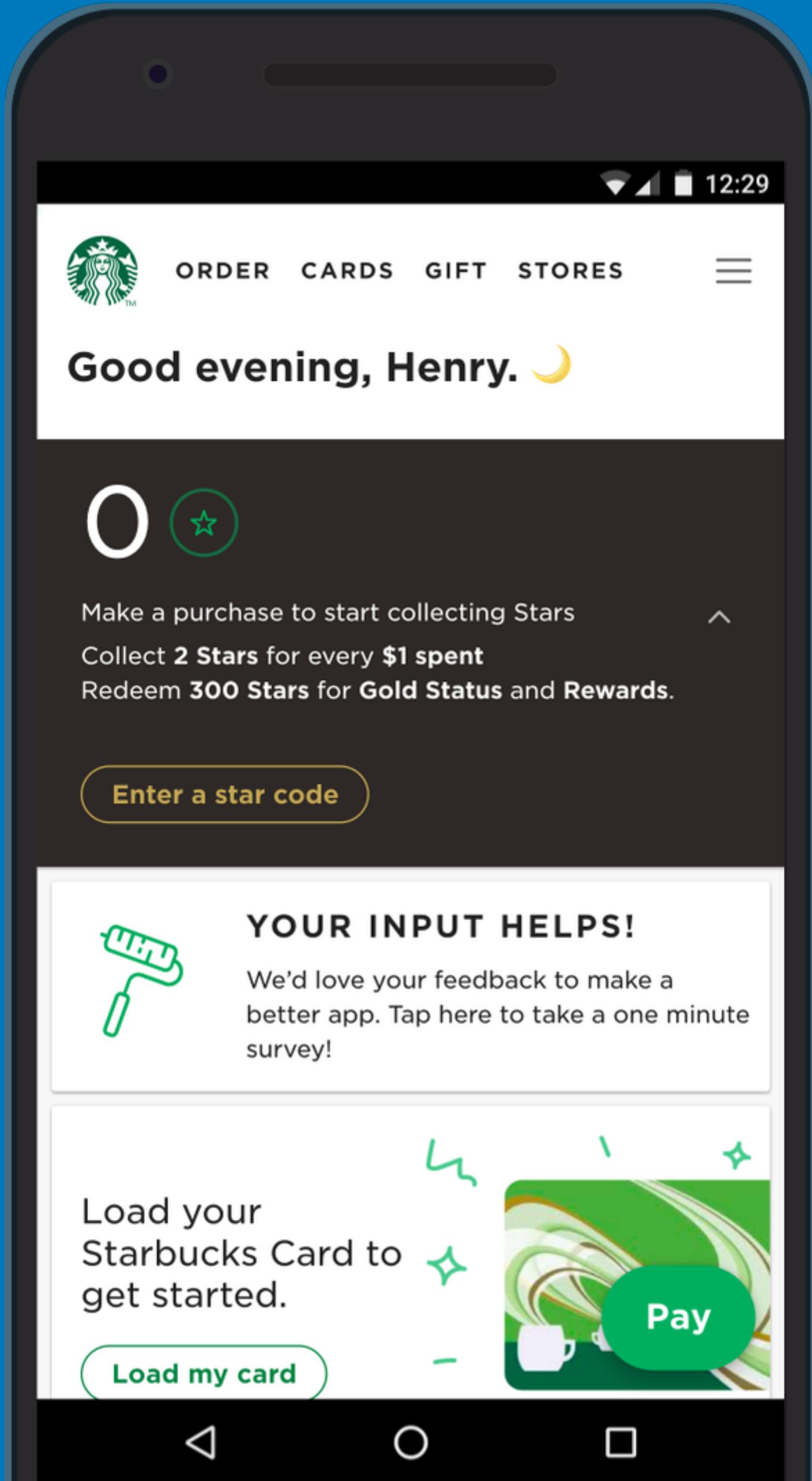
PWA

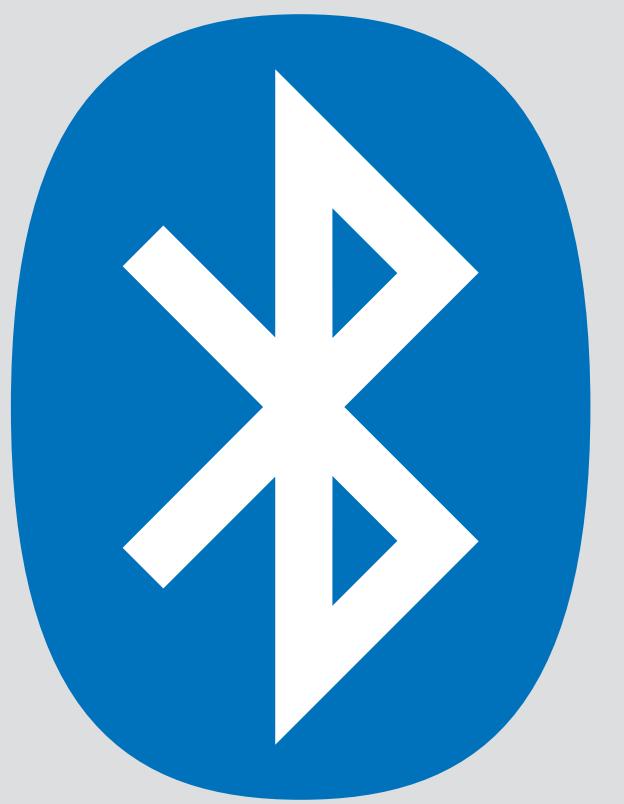
*progressive
web apps*

*pwa's
zijn geweldig !*

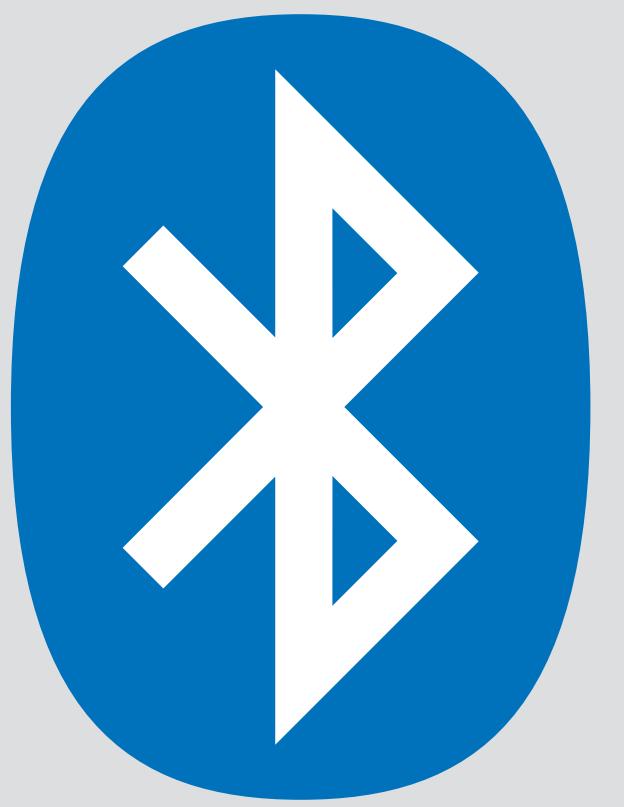


maar...

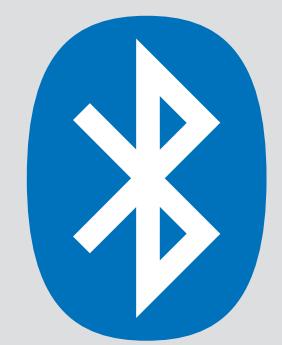




bluetooth

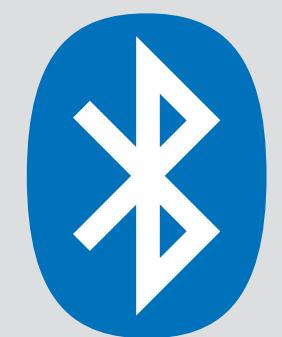


bluetooth
zuiqt



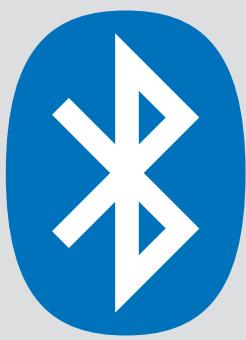
classic bluetooth

vs.

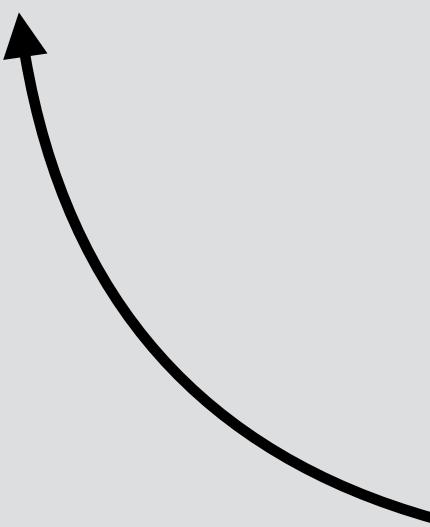


bluetooth low energy

iedereen bluetooth waarom
de reden waarom
bedien drones en andere coole shit



bluetooth low energy



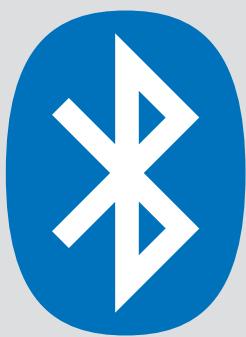
ook bekend als

Bluetooth Smart

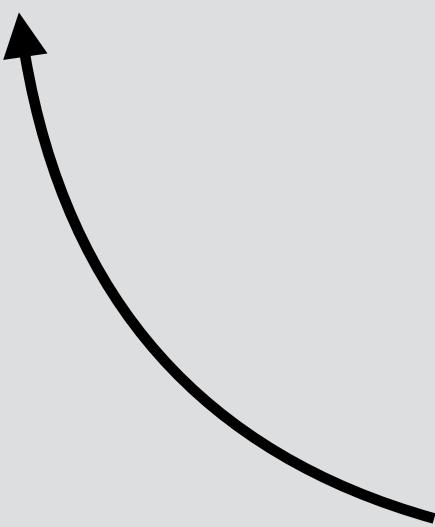
BLE

Bluetooth LE

Bluetooth 4



bluetooth low energy



ook bekend als

Bluetooth Smart

BLE

Bluetooth LE

Bluetooth 4 and 5

10 miljoen
apparaten
met bluetooth worden
elke dag gemaakt

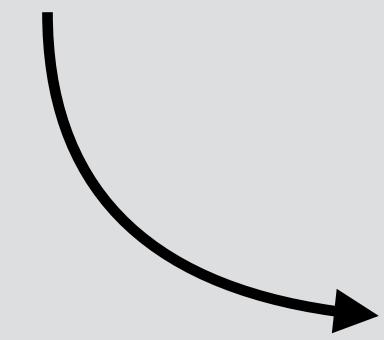


mobiele telefoon

computer



glucosemeter



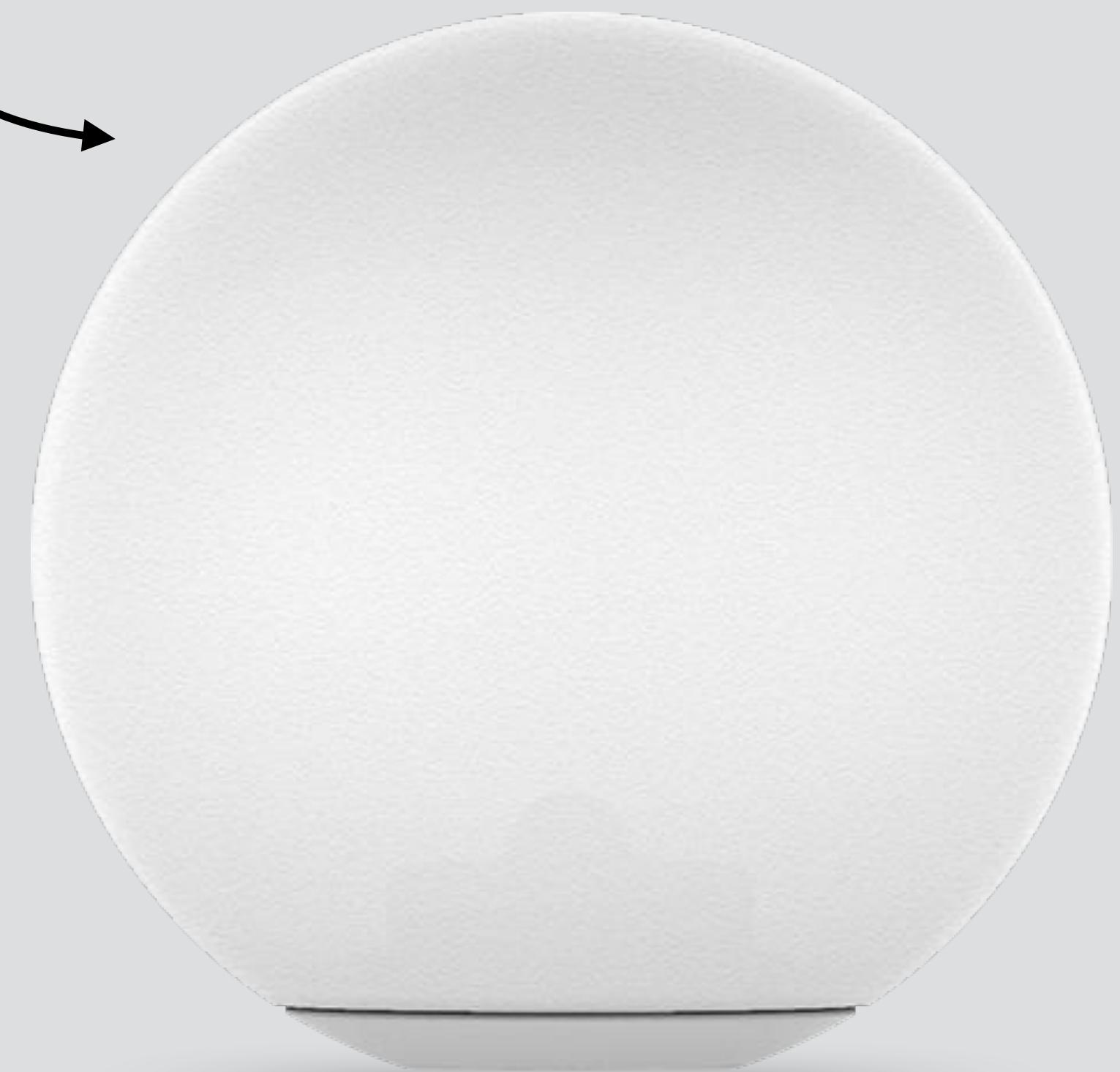
iemands hand



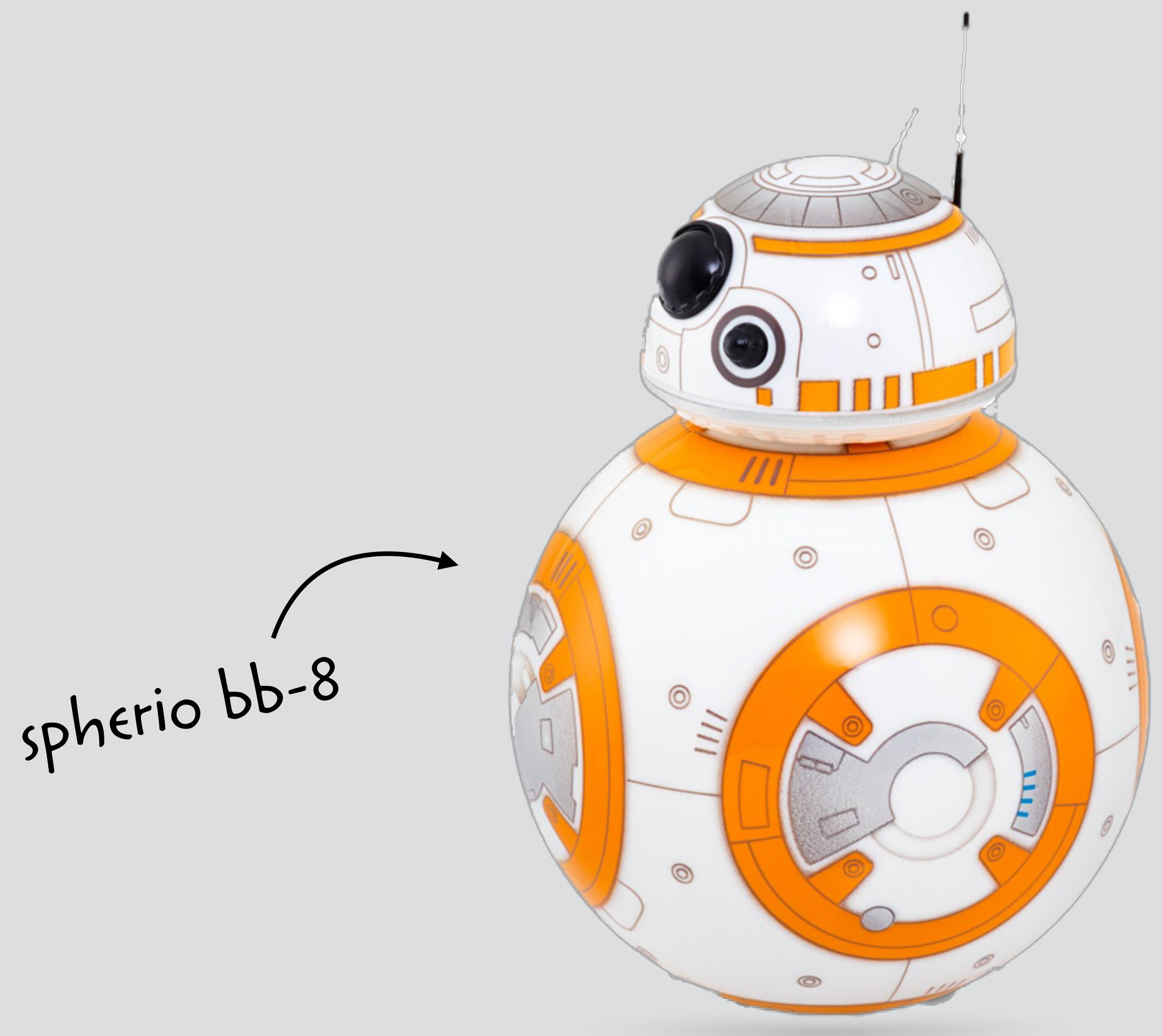


sporthorloge

Playbulb sphere



playbulb



sphero bb-8



parrot mini drone



fidget spinner

de saaie theorie



central



peripheral



central



generic attribute profile

generic attribute profile ?

generic attribute profile



gatt, omdat GAP al in gebruik was



~~central~~
~~client~~

~~peripheral~~
~~server~~



light

meerdere services per apparaat



device information



battery



flight control



device information



battery



steering control





i

device information



battery



heart rate





heart rate



device information



battery



heart rate





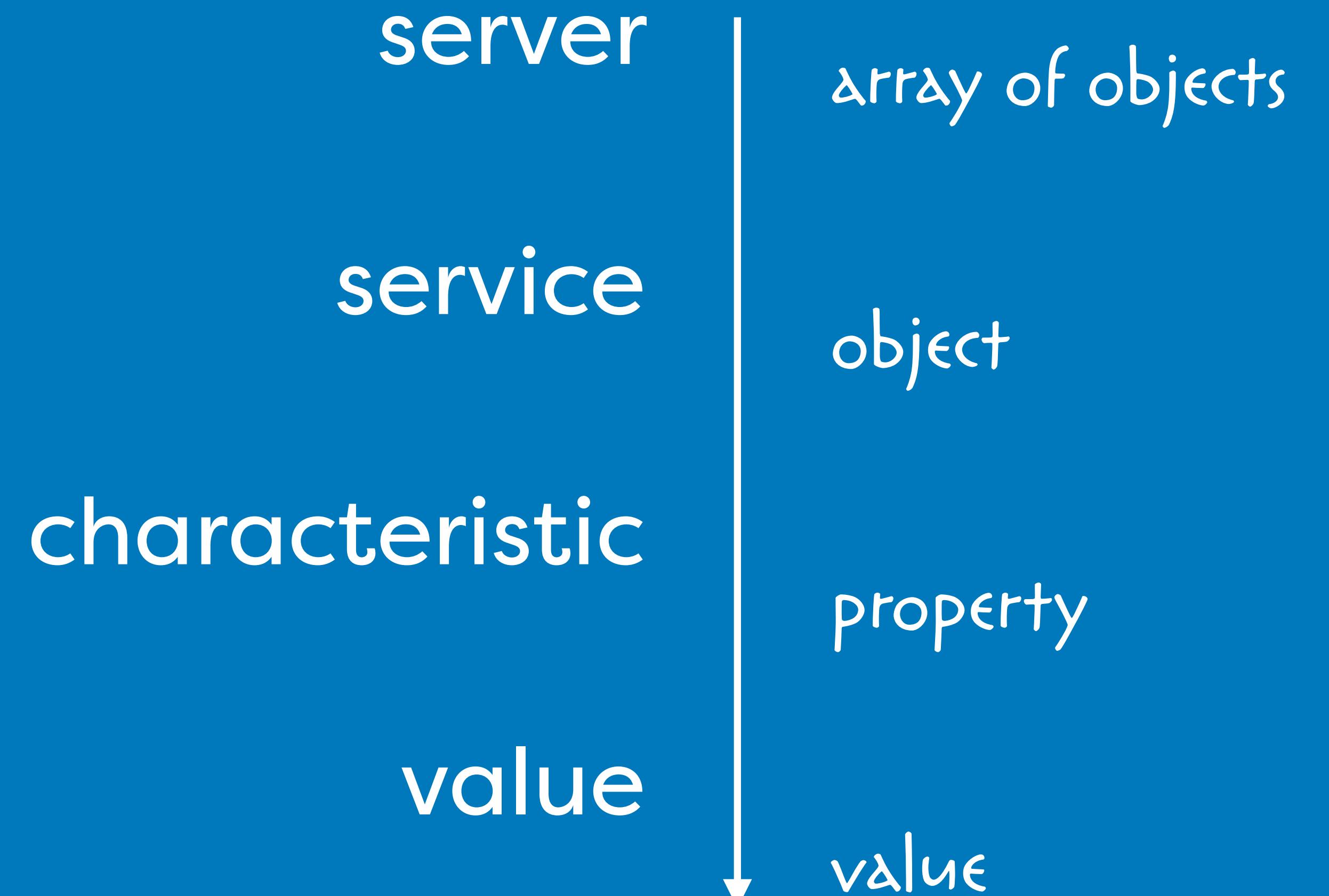
device information

- manufacturer
- model number
- serial number
- hardware revision
- firmware revision
- software revision

...



meerdere characteristics
per service



services en characteristics
hebben altijd een uuid

16 bit of 128 bit



device information



16 bit 0x180A

128 bit 0000180A-0000-1000-8000-00805F9B34FB



16 bit 0x180F

128 bit 0000180F-0000-1000-8000-00805F9B34FB



light



steering control



flight c

16 bit

wordt afgeraden

128 bit

elke UUID behalve de reeks

xxxxxxxx-0000-1000-8000-00805F9B34FB



maar iedereen doet het toch



device information

manufacturer

model number

serial number

hardware revision

firmware revision

software revision

...



i

0x180A

0x2A29
0x2A24
0x2A25
0x2A27
0x2A26
0x2A28

...



goed voor de duidelijkheid,
slecht voor het besparen van data

elke characteristic ondersteund
een of meer van deze



lezen

schrijven

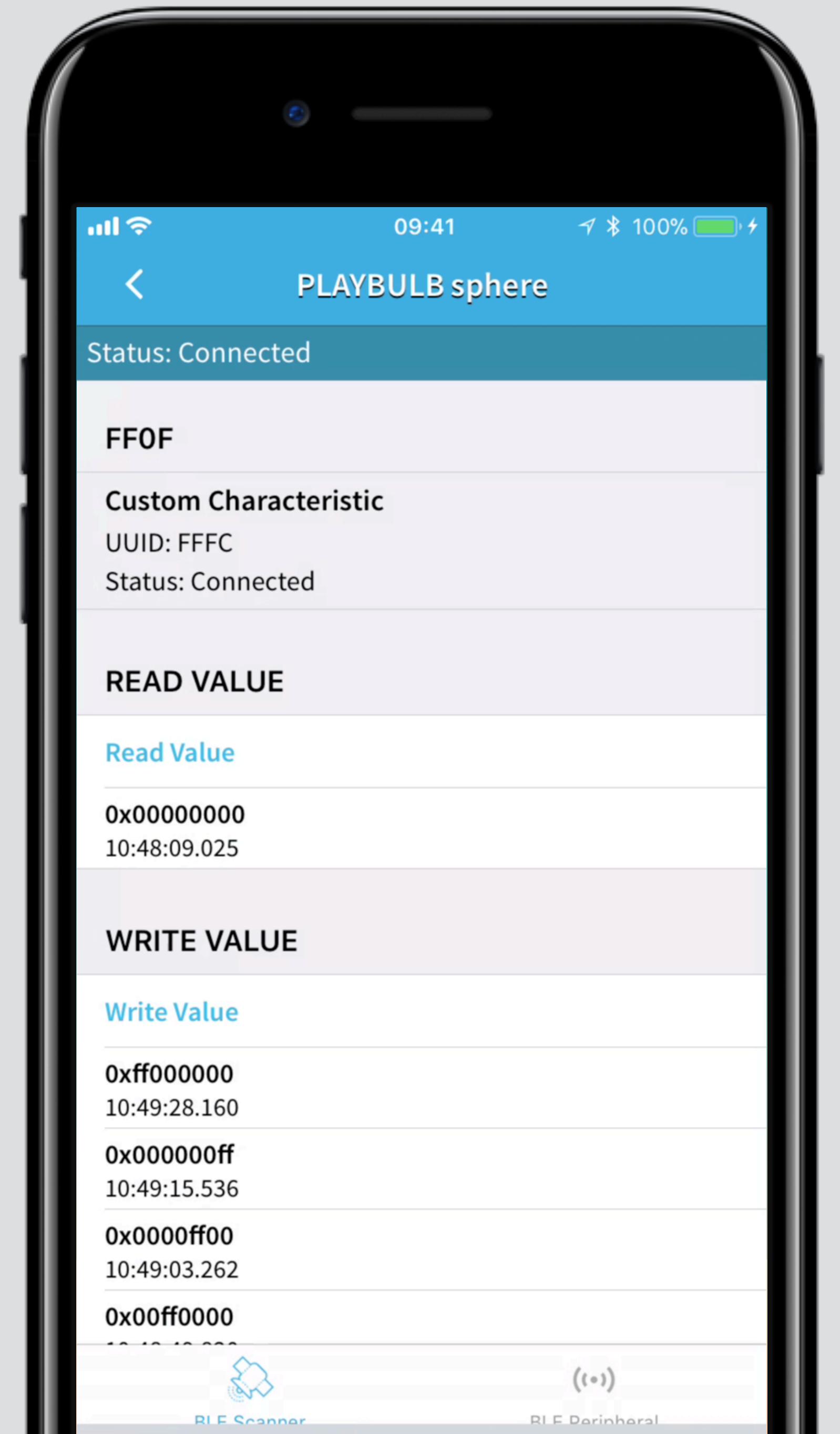
schrijven zonder bevestiging

notificatie

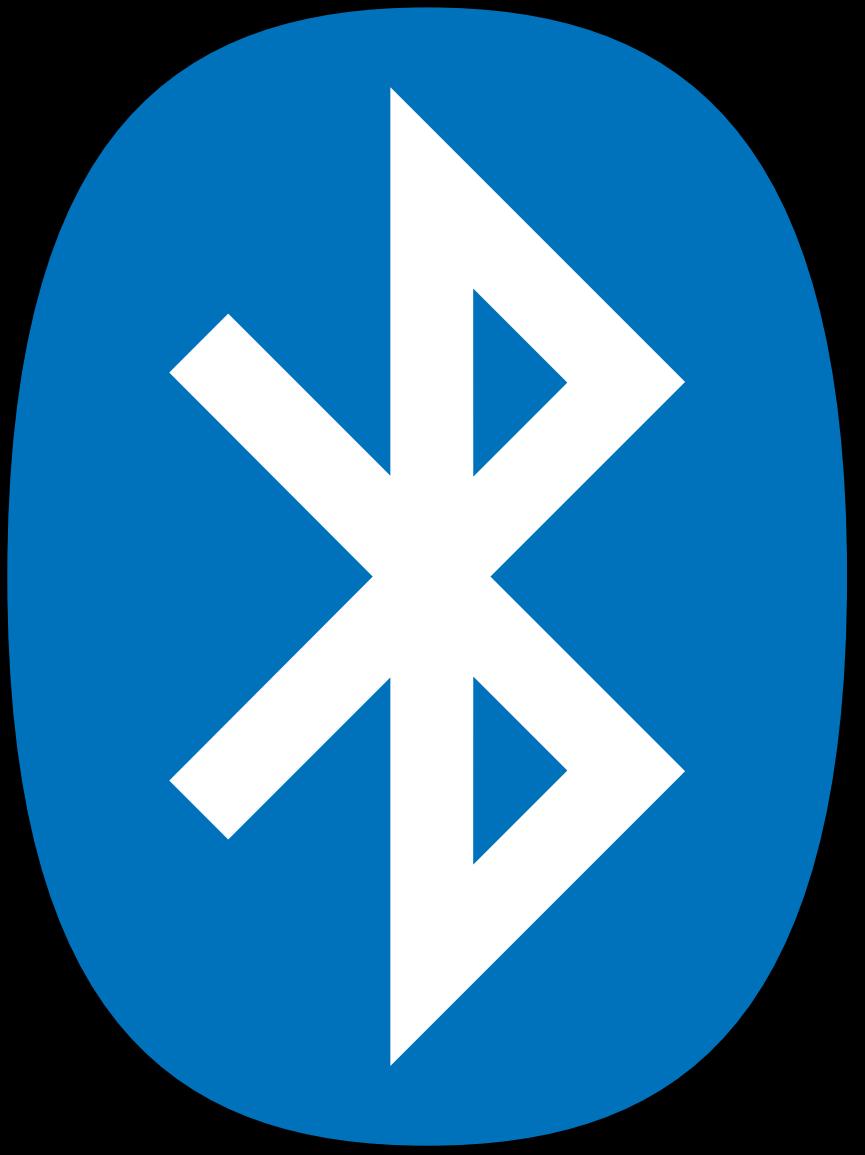
elke waarde is een array van bytes

geen hogere datatypes, alleen bytes

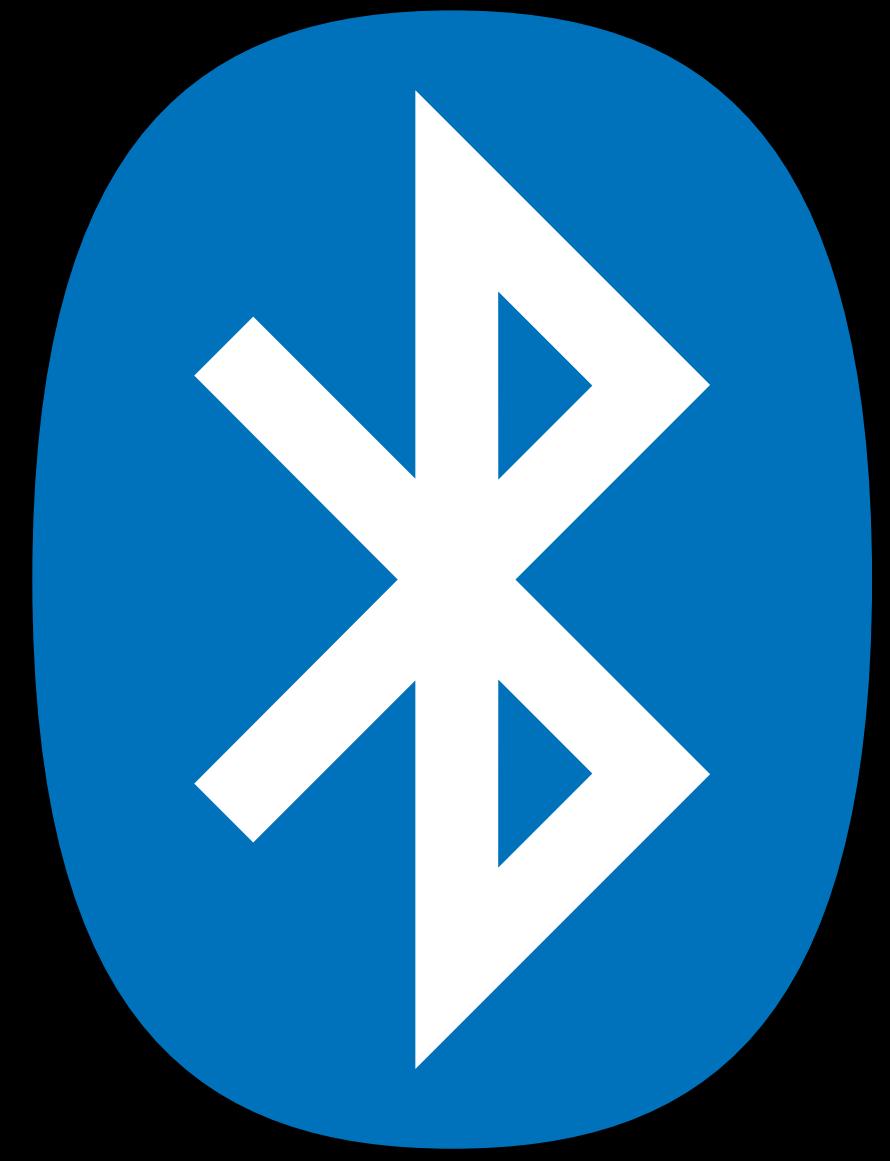
pfeu...



sadie feiten
over
~~fun with~~
bluetooth



*fun with
bluetooth*



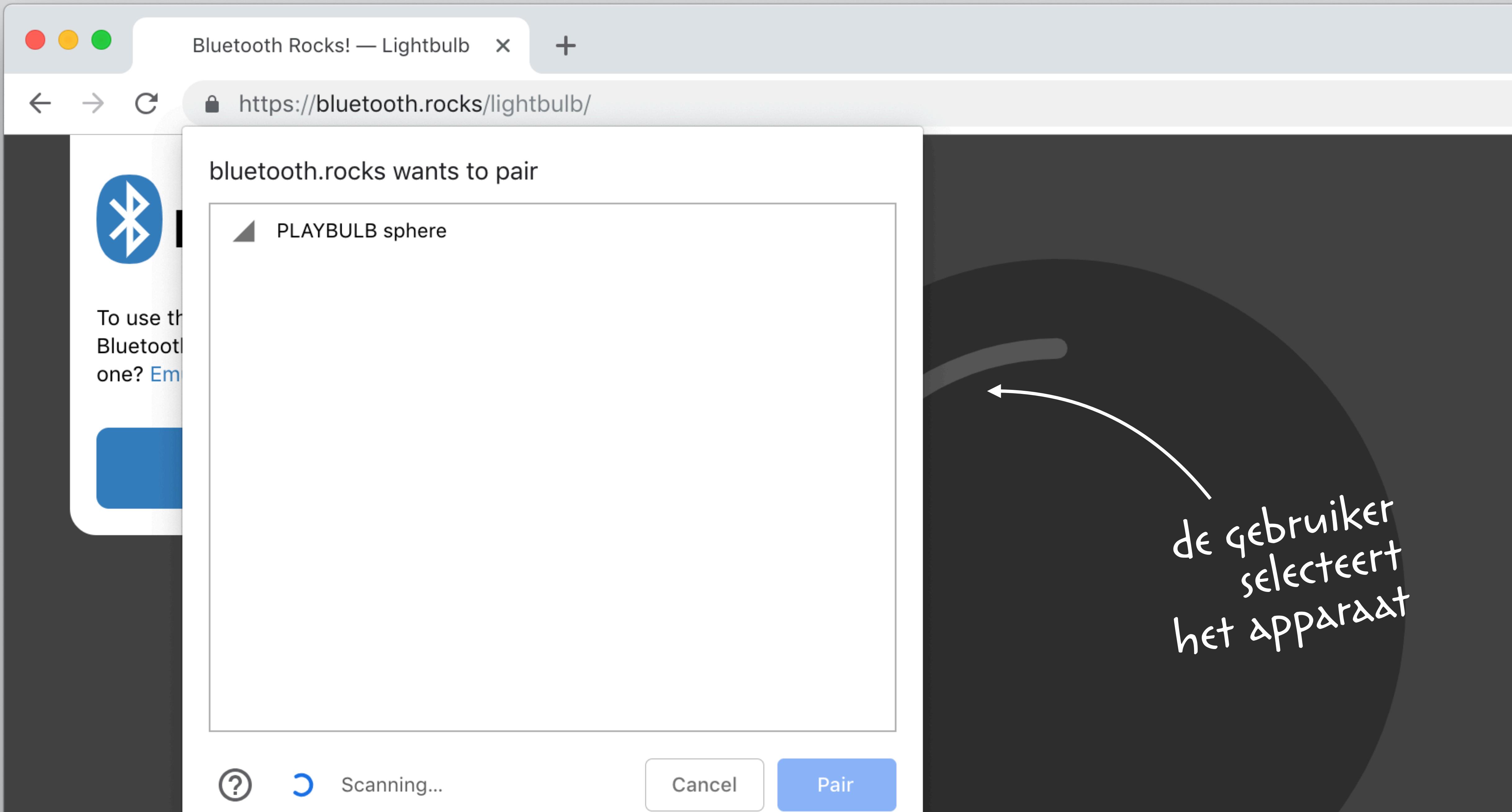
*web
bluetooth
api*

nooit steeds niet het leuke gedeelte
:-)

verbinden met een apparaat

```
navigator.bluetooth.requestDevice({  
    filters: [  
        { namePrefix: 'PLAYBULB' }  
    ],  
    optionalServices: [ 0xff0f ]  
})
```

we vertellen de browser wat
voor soort apparaat we willen



```
navigator.bluetooth.requestDevice({  
    filters: [  
        { namePrefix: 'PLAYBULB' }  
    ],  
    optionalServices: [ 0xff0f ]  
})  
.then(device => {  
    ...  
})
```

promises zijn zo 2017

```
let device = await navigator.bluetooth.requestDevice({  
  filters: [  
    { namePrefix: 'PLAYBULB' }  
  ],  
  optionalServices: [ 0xff0f ]  
});
```

```
let device = await navigator.bluetooth.requestDevice({  
    filters: [  
        { namePrefix: 'PLAYBULB' }  
    ],  
    optionalServices: [ 0xff0f ]  
});
```

verbind met de server

```
let server = await device.gatt.connect();  
let service = await server.getPrimaryService(0xff0f);  
let characteristic = await service.getCharacteristic(0xffffc);
```

haal de service

haal de characteristic

data schrijven

schrijf een paar bytes

```
let device = await navigator.bluetooth.requestDevice({ ... });
let server = await device.gatt.connect();
let service = await server.getPrimaryService(0xff0f);
let characteristic = await service.getCharacteristic(0xffffc);

characteristic.writeValue(
    new Uint8Array([ 0x00, r, g, b ])
);
```

data lezen

lees een paar bytes

```
let device = await navigator.bluetooth.requestDevice({ ... });
let server = await device.gatt.connect();
let service = await server.getPrimaryService(0xff0f);
let characteristic = await service.getCharacteristic(0xffffc);

let value = await characteristic.readValue();

let r = value.getInt8(1);
let g = value.getInt8(2);
let b = value.getInt8(3);
```

krijg bericht van wijzigingen

addeventlistener

```
let device = await navigator.bluetooth.requestDevice({ ... });
let server = await device.gatt.connect();
let service = await server.getPrimaryService(0xff0f);
let characteristic = await service.getCharacteristic(0xffffc);

characteristic.addEventListener(
  'characteristicvaluechanged', e => {
    let r = e.target.value.getUint8(1);
    let g = e.target.value.getUint8(2);
    let b = e.target.value.getUint8(3);
  }
);
characteristic.startNotifications();
```

vergeet niet om te luisteren

dingen die je moet weten:

- de webbluetooth api
- promises (of async await)
- typed arrays

duh!

browser support



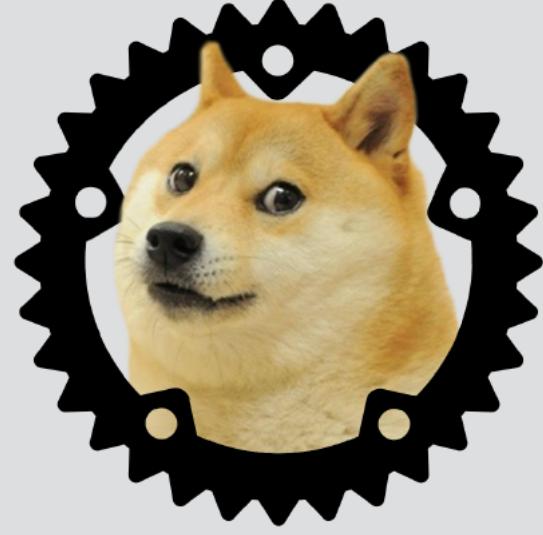
Chrome



Edge
(soon)



Samsung



Servo
(soon)

browser support



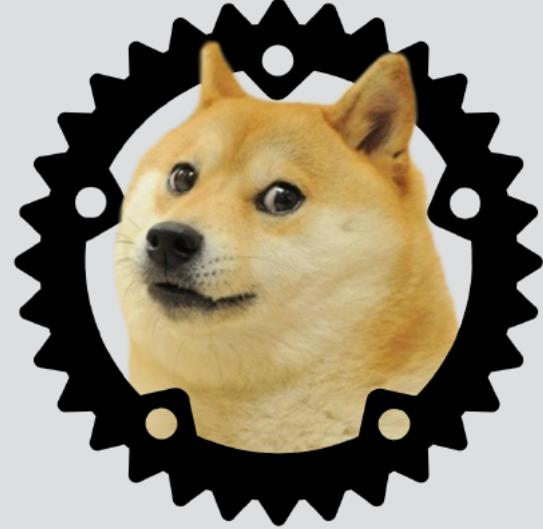
Chrome



Edge
(soon)



Samsung



Servo
(soon)



iOS

browser support



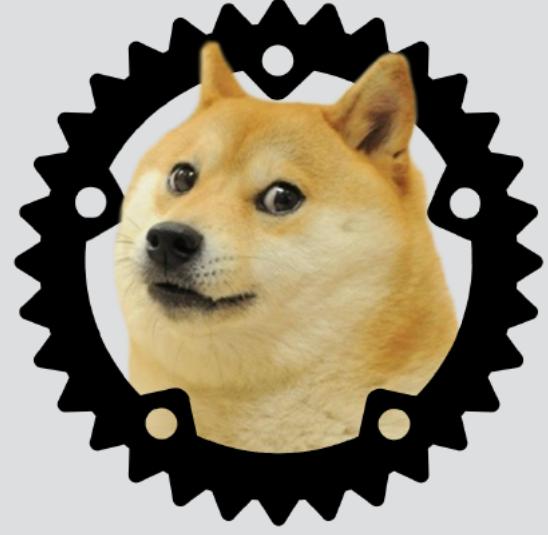
Chrome



Edge
(soon)



Samsung



Servo
(soon)



iOS

browser support



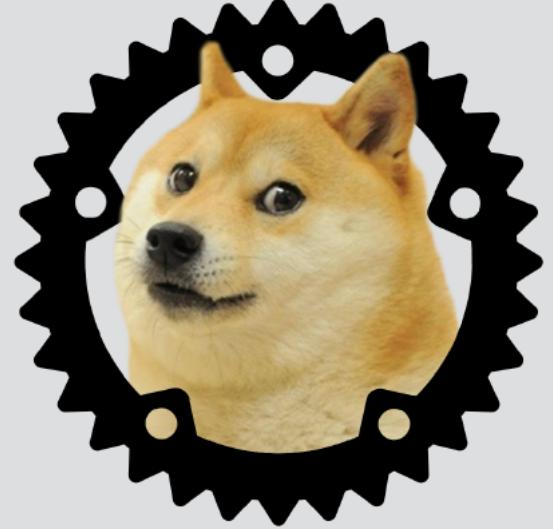
Chrome



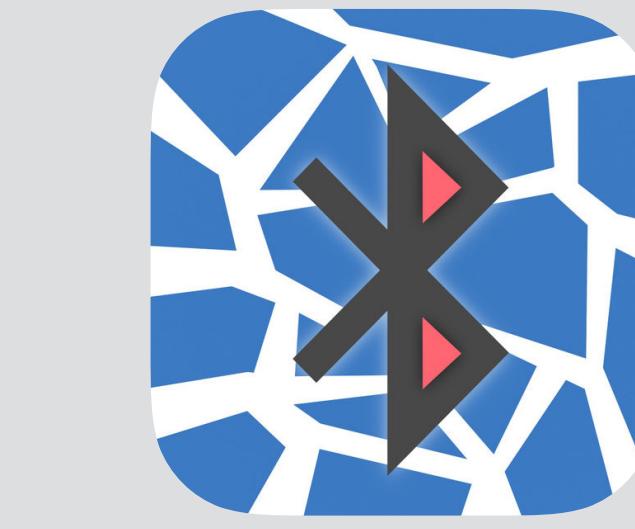
Edge
(soon)



Samsung



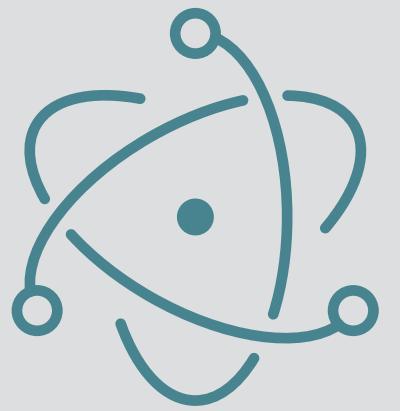
Servo
(soon)



WebBLE
for iOS

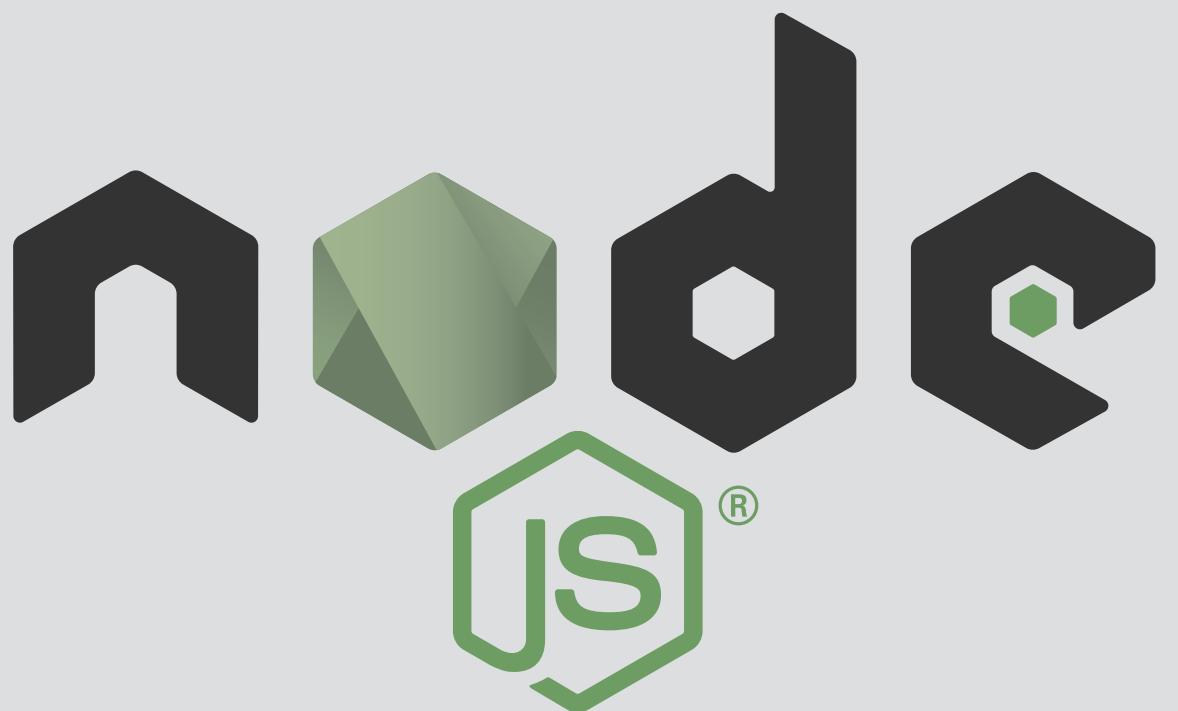
kinda works

en...



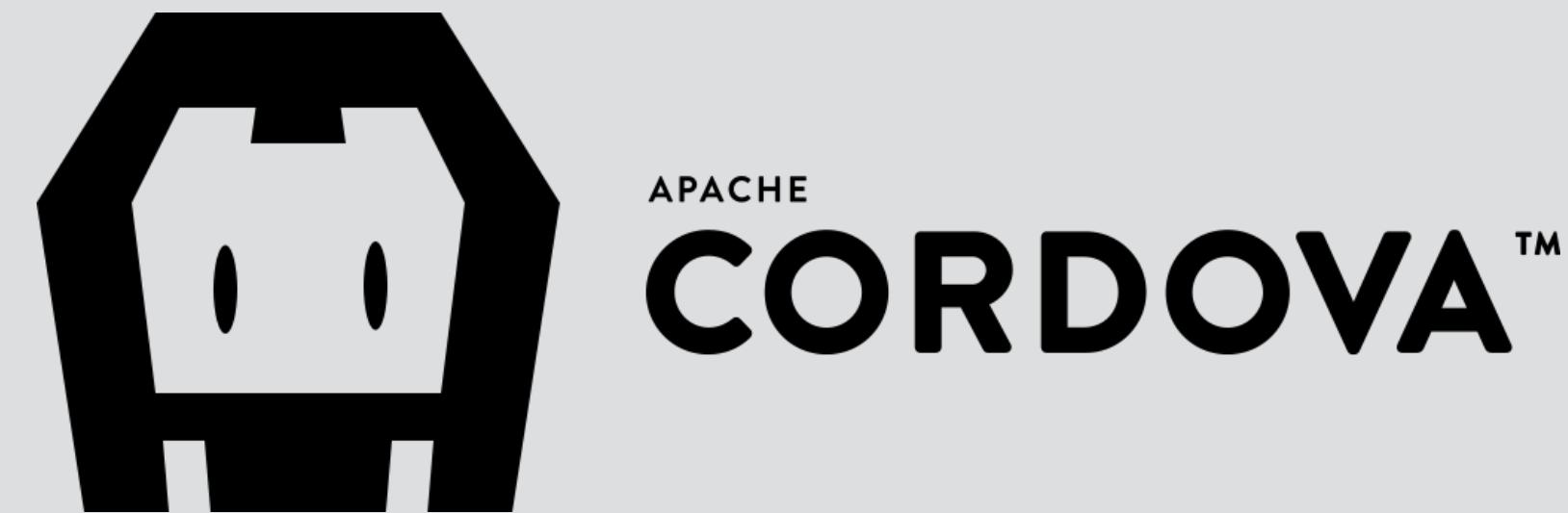
ELECTRON

en...



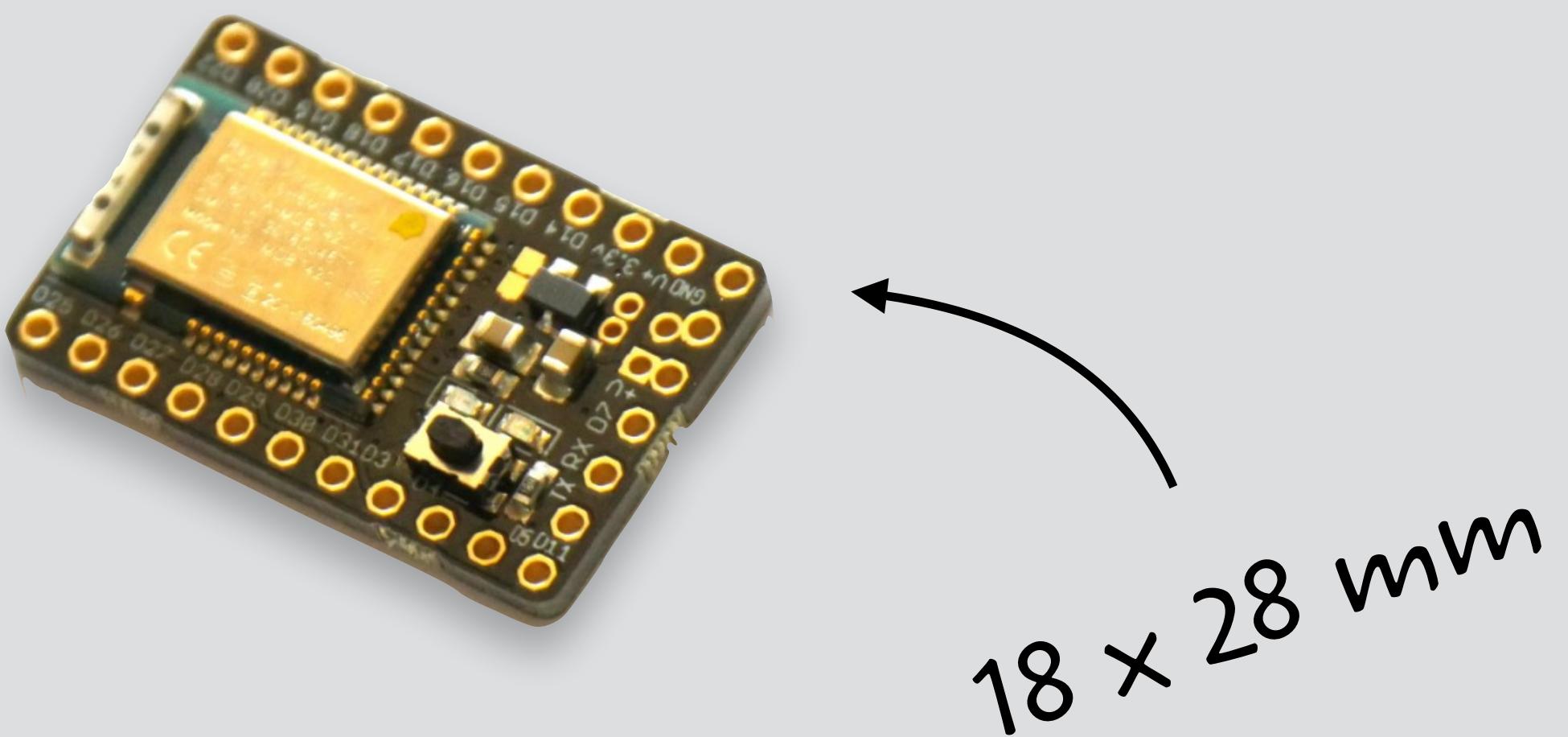
npm install node-web-bluetooth

en...



`npm install cordova-plugin-webbluetooth`

en... espruino



*custom
characteristics wtf!*



writing a value:

```
function(r, g, b) {  
    return new Uint8Array([ 0x00, r, g, b ]);  
}
```

reading a value:

```
function(buffer) {  
    return {  
        r: buffer.getInt8(1),  
        g: buffer.getInt8(2),  
        b: buffer.getInt8(3)  
    }  
}
```



writing to and reading
from the same characteristic

writing a value:

```
function(r, g, b) {  
    return new Uint8Array([  
        0x01, g, 0x01, 0x00, 0x01,  
        b, 0x01, r, 0x01, 0x00  
    ]);  
}
```



reading the current
color is not possible

writing a value:

```
function(r, g, b) {  
    var buffer = new Uint8Array([  
        0xaa, 0x0a, 0xfc, 0x3a, 0x86, 0x01, 0x0d,  
        0x06, 0x01, r, g, b, 0x00, 0x00,  
        (Math.random() * 1000) & 0xff, 0x55, 0x0d  
    ]);  
  
    for (var i = 1; i < buffer.length - 2; i++) {  
        buffer[15] += buffer[i];  
    }  
  
    return buffer;  
}
```



reading the current color is not possible

writing a value:

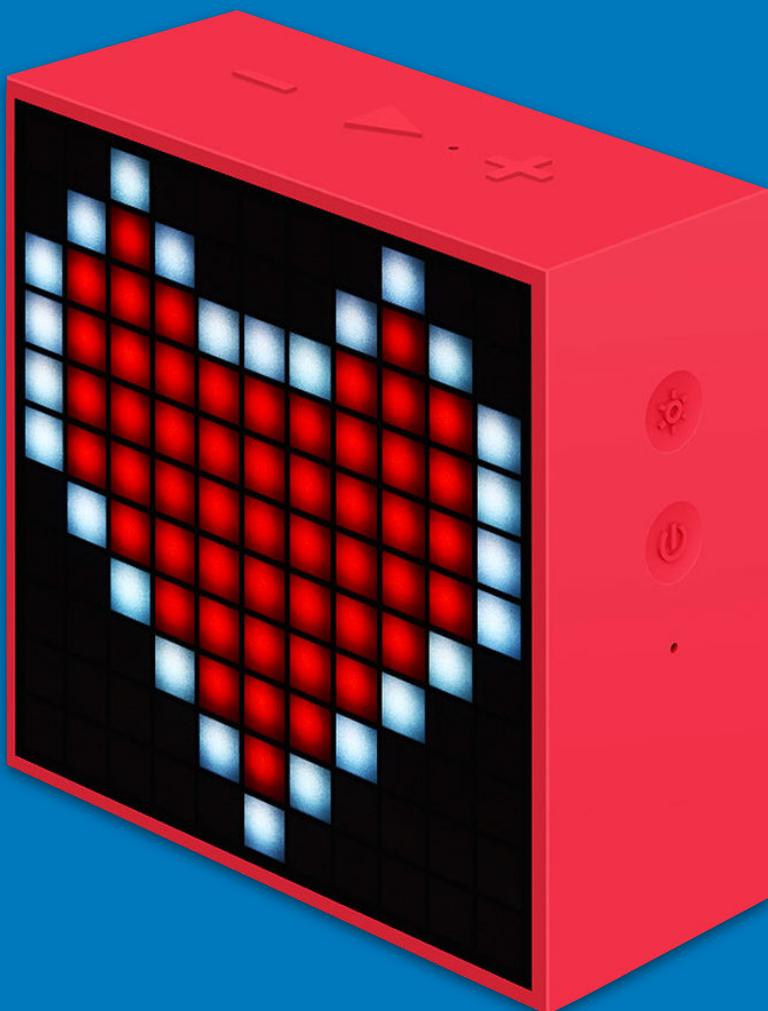
```
function(r, g, b, position) {  
    let buffer = new Uint8Array([  
        0x07, 0x02, position + 1, r, g, b  
    ]);  
  
    return buffer;  
}
```



writing a value:

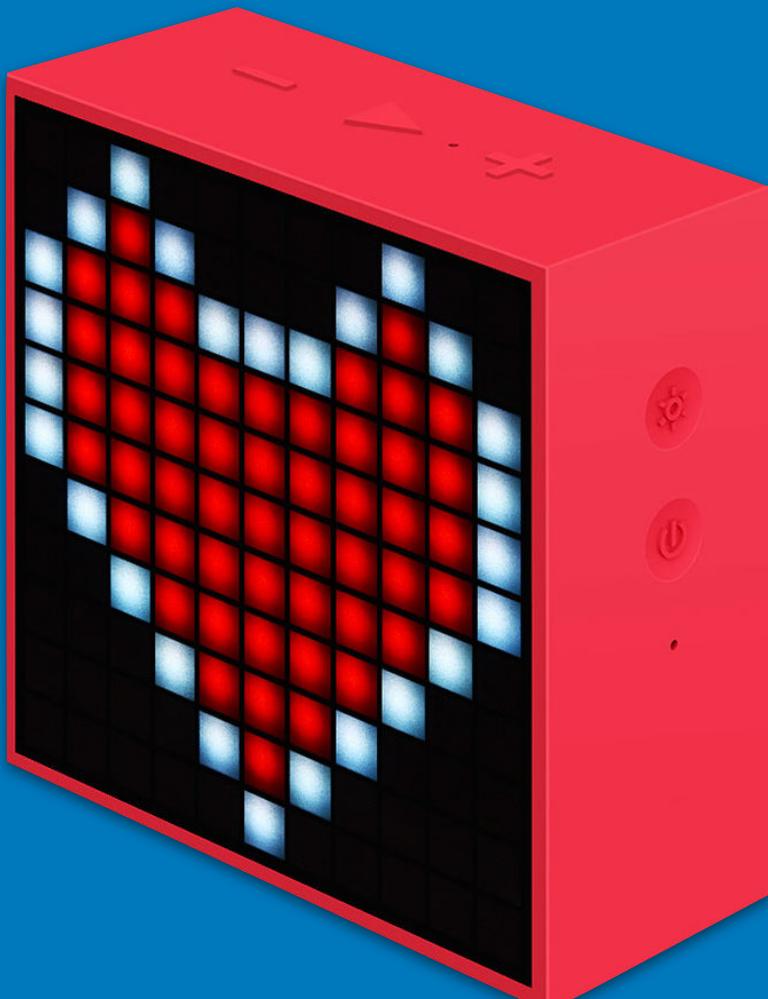
```
function(r, g, b, position) {  
    let buffer = new Uint8Array([  
        0x58, r, g, b, 0x01, position  
    ]);
```

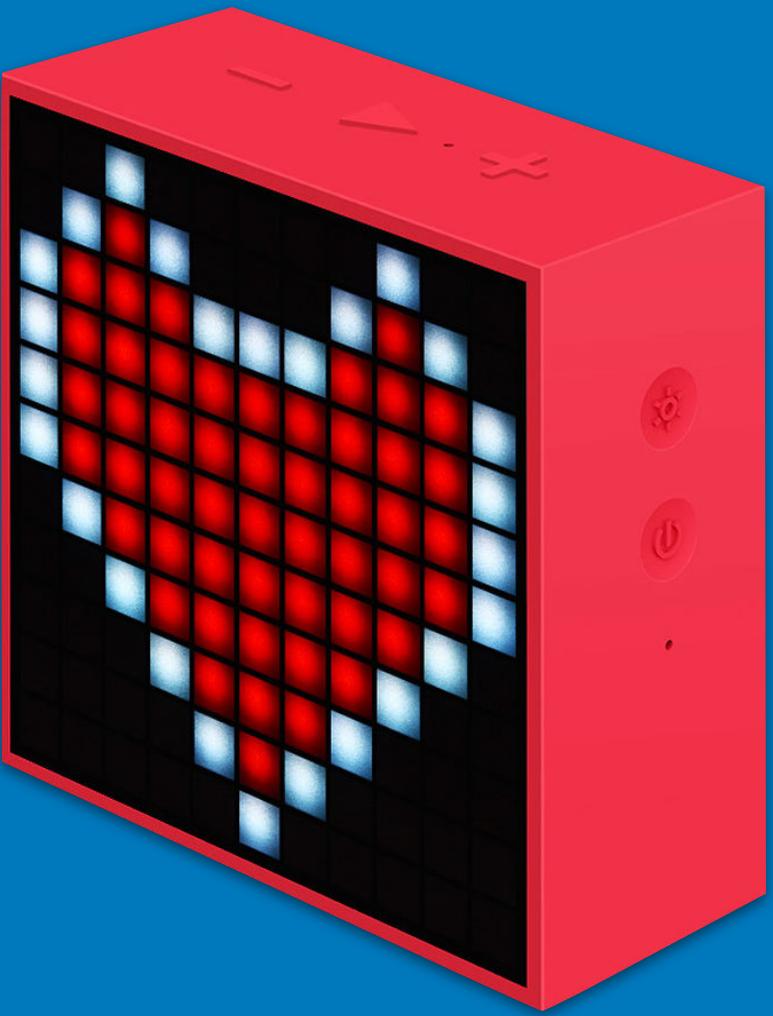
...



writing a value:

```
function(r, g, b, position) {  
    let buffer = new Uint8Array([  
        0x58, r, g, b, 0x01, position  
    ]);  
  
    let payload = new Uint8Array(buffer.length + 4);  
    payload[0] = payload.length - 2;  
    payload[1] = payload.length - 2 >>> 8;  
    payload.set(buffer, 2);  
  
    let checksum = payload.reduce((a, b) => a + b, 0);  
    payload[payload.length - 2] = checksum;  
    payload[payload.length - 1] = checksum >>> 8;  
  
    let extra = payload.filter(value => {
```





```
        message[m] = 0x03;
        message[m + 1] = 0x05;
        m += 2;
    }
    else if (payload[i] === 0x03) {
        message[m] = 0x03;
        message[m + 1] = 0x06;
        m += 2;
    }
    else {
        message[m] = payload[i];
        m++;
    }
}

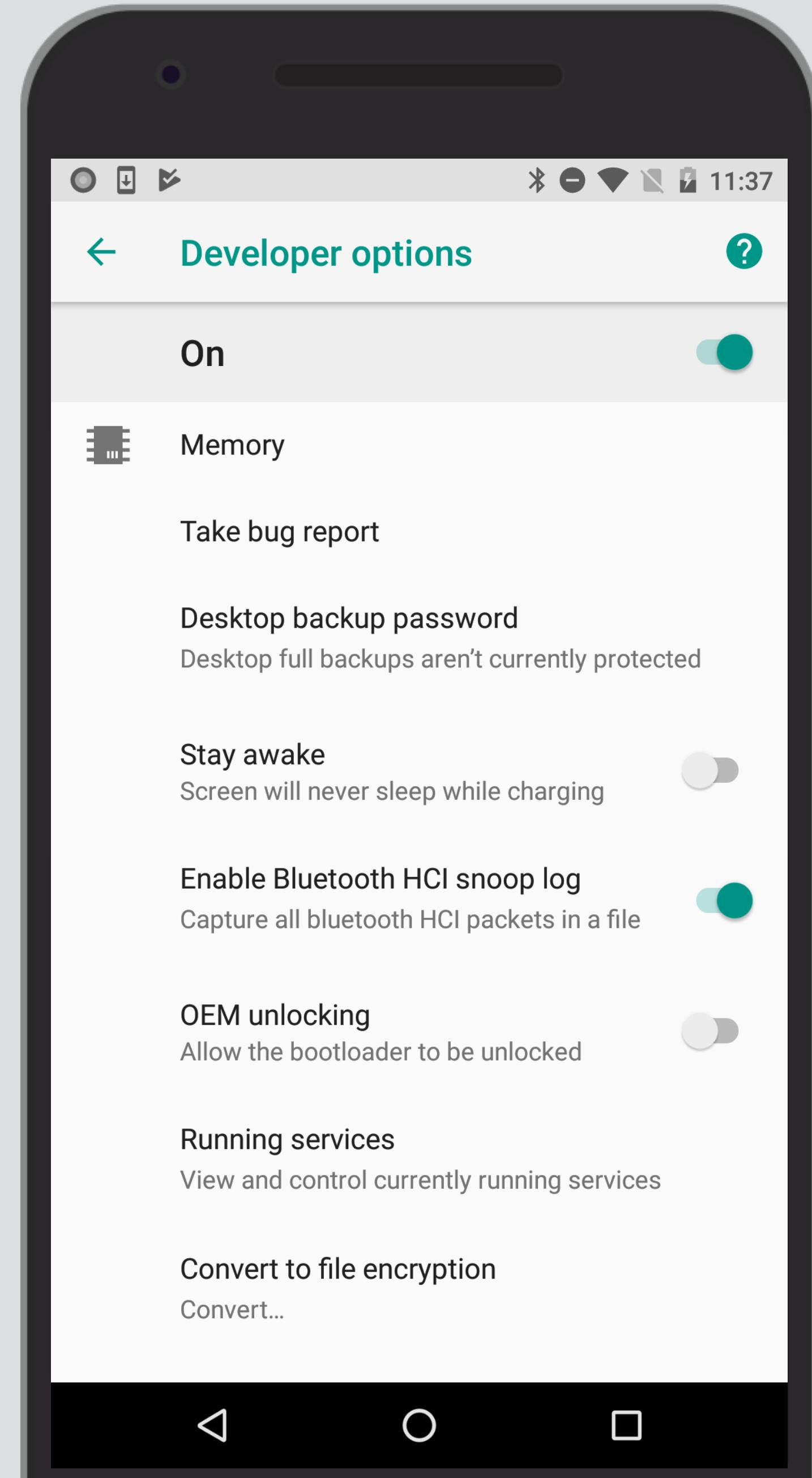
message[0] = 0x01;
message[message.length - 1] = 0x02;

return message;
}
```



*adafruit
bluetooth
sniffer*

*log alle
bluetooth
packets
op jouw telefoon*



en gebruik adb
om ze over
te zetten

btsnoop_hci.log

Apply a display filter ... <⌘/>

No.	Time	Source	Destination	Protocol	Length	Value
3620	118.078099	controller	host	HCI_EVT	8	
3621	118.137911	LgElectr_6c:eb:b9 ...	remote ()	ATT	32	fa030039010006000000000000000000000000003c300
3622	118.140070	LgElectr_6c:eb:b9 ...	remote ()	ATT	32	00000003c30000000003c30000000000fc000000
3623	118.142233	LgElectr_6c:eb:b9 ...	remote ()	ATT	32	0000300000000000030000000000300000000000000000
3624	118.144795	LgElectr_6c:eb:b9 ...	remote ()	ATT	16	000b55a9
3625	118.166811	controller	host	HCI_EVT	8	
3626	118.166955	controller	host	HCI_EVT	8	
3627	118.167380	controller	host	HCI_EVT	8	
3628	118.168192	controller	host	HCI_EVT	8	
3629	118.230426	LgElectr_6c:eb:b9 ...	remote ()	ATT	32	fa030039010006000000000000000000000000f0c000
3630	118.232516	LgElectr_6c:eb:b9 ...	remote ()	ATT	32	000000f0c000000000f0c0000000003f0f000000
3631	118.234390	LgElectr_6c:eb:b9 ...	remote ()	ATT	32	000c0f000000000c0f00000000c00000000000000000
3632	118.236671	LgElectr_6c:eb:b9 ...	remote ()	ATT	16	000b55a9
3633	118.256972	controller	host	HCI_EVT	8	
3634	118.257299	controller	host	HCI_EVT	8	
3635	118.258136	controller	host	HCI_EVT	8	
3636	118.258542	controller	host	HCI_EVT	8	
3637	118.322899	LgElectr_6c:eb:b9 ...	remote ()	ATT	32	fa0300390100060000000000000000000000003c300000

Frame 3629: 32 bytes on wire (256 bits), 32 bytes captured (256 bits)

► Bluetooth

► Bluetooth HCI H4

► Bluetooth HCI ACL Packet

► Bluetooth L2CAP Protocol

▼ Bluetooth Attribute Protocol

- Opcode: Write Command (0x52)
- Handle: 0x0011 (9ecadc240ee5a9e093f3a3b50200406e)

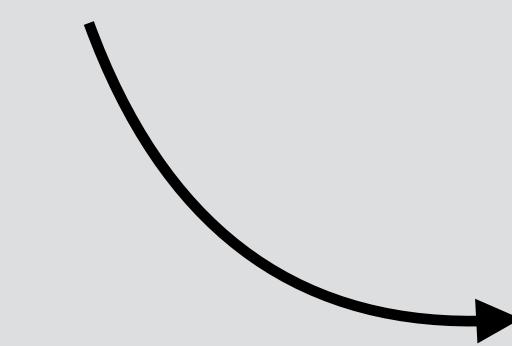
Value: fa030039010006000000000000000000000000f0c000

0000	02 02 00 1b 00 17 00 04 00 52 11 00 fa 03 00 39 R....9
0010	01 00 06 00 00 00 00 00 00 00 00 00 f0 c0 00

Value (btatt.value), 20 bytes

Packets: 4148 · Displayed: 4148 (100.0%) · Load time: 0:0.7

gebruik wireshark om
de data te bekijken



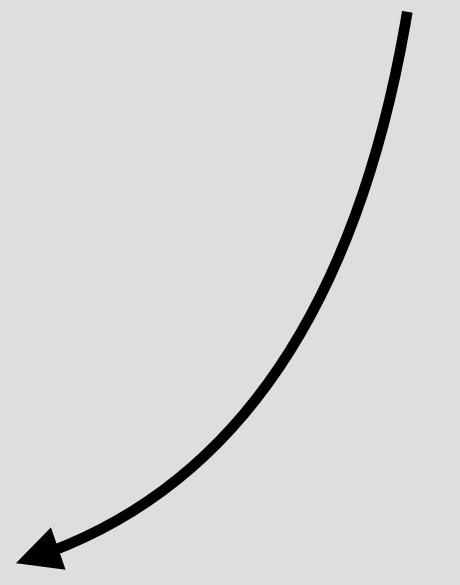
*de apk
decompilen*



niet verklappen!

eindelijk het leuke gedeelte

demo





waarschuwing experimentele technologie

lage verwachtingen scheppen



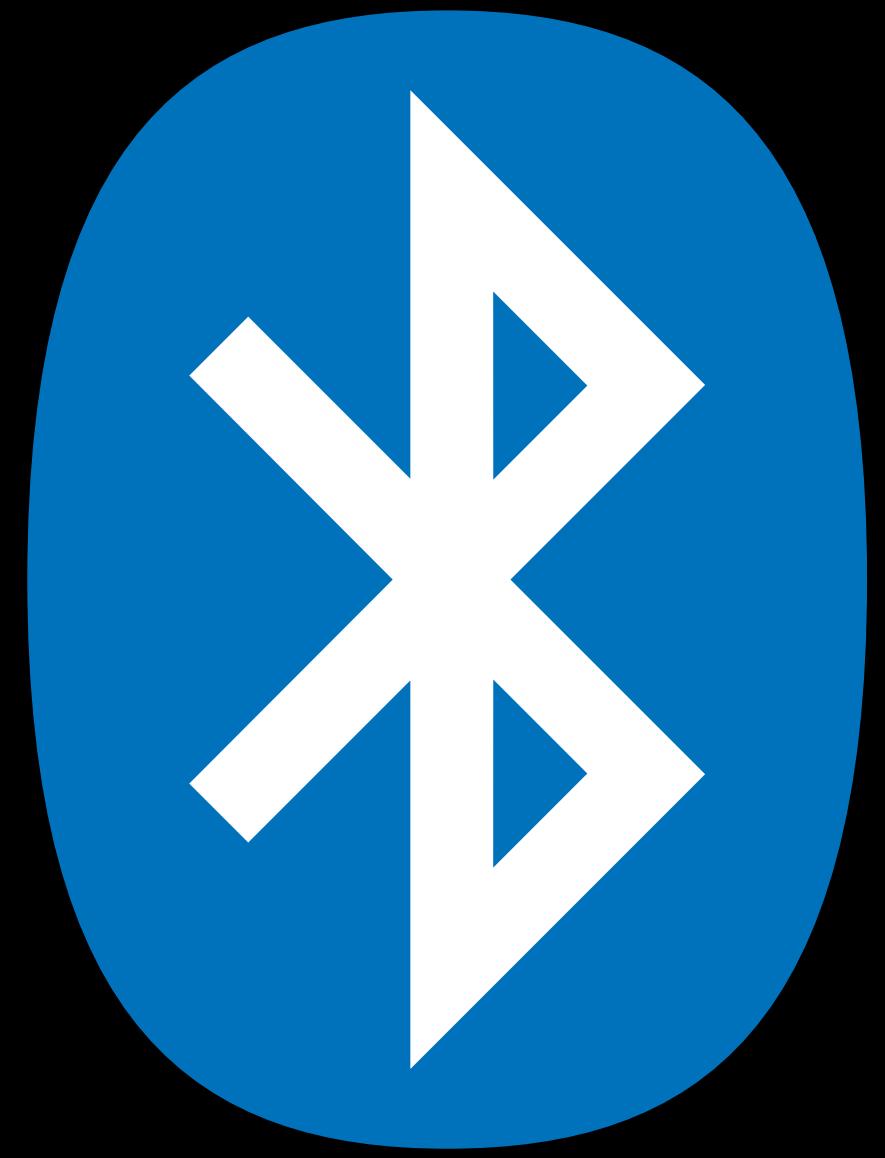
waarschuwing

wifi interferentie



zet de lat nog maar wat lager!

*fun with
bluetooth!*



vragen?

@html5test