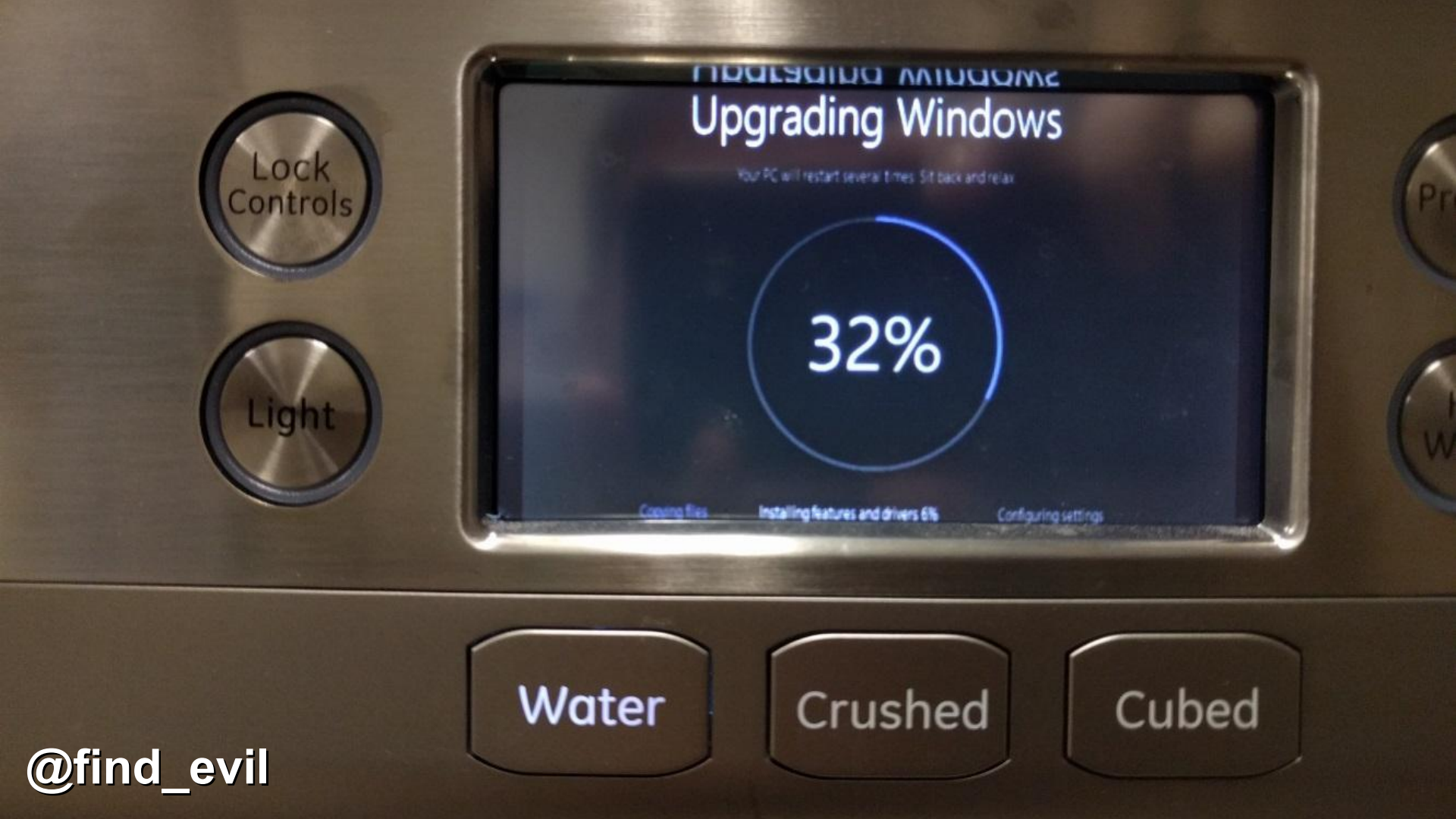
Crossing the IoT Chasm

Kevin Hoyt, IBM
@krhoyt

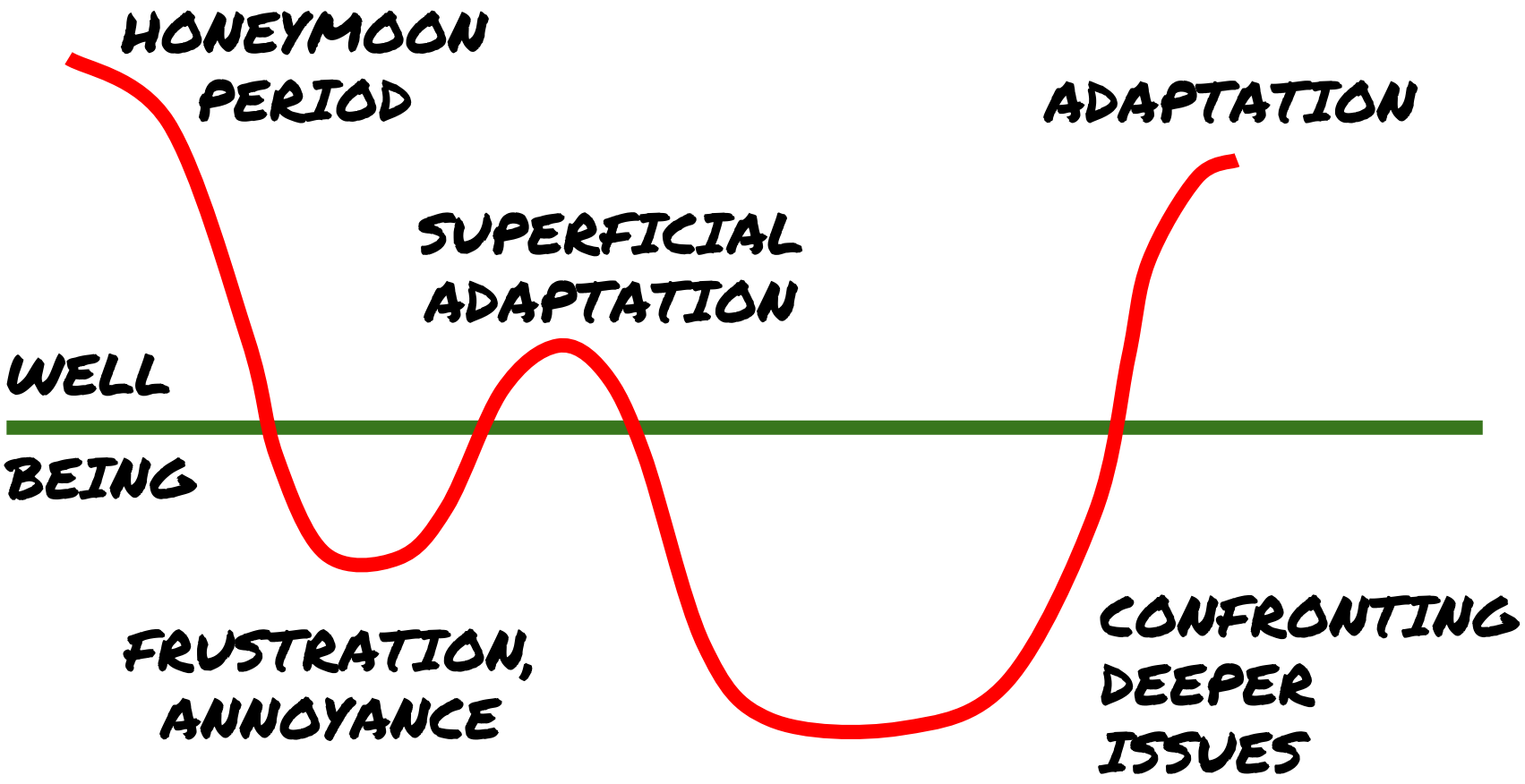

LG
RECIPE
Find a recipe that suits your taste
Today's Pick
Strawberry Cookie Bars
All
Course
Cuisine
Favorite
5 Minute Horseradish Sauce
5 Spice Chicken Wing

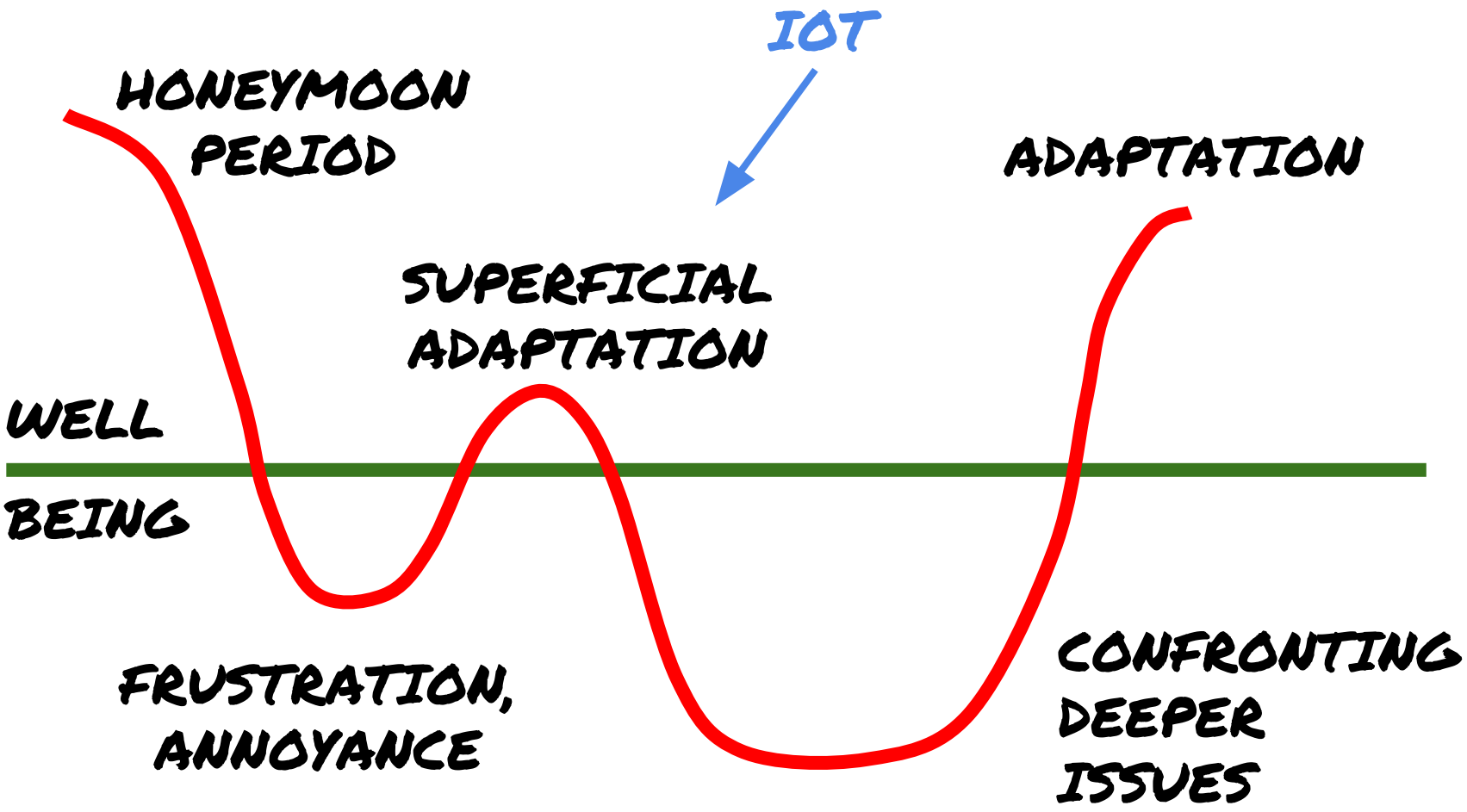

Lock Controls
Light
Upgrading Windows
Your PC will restart several times. Sit back and relax
32%
Copying files
Installing features and drivers 6%
Configuring settings
Water
Crushed
Cubed
@find_evil

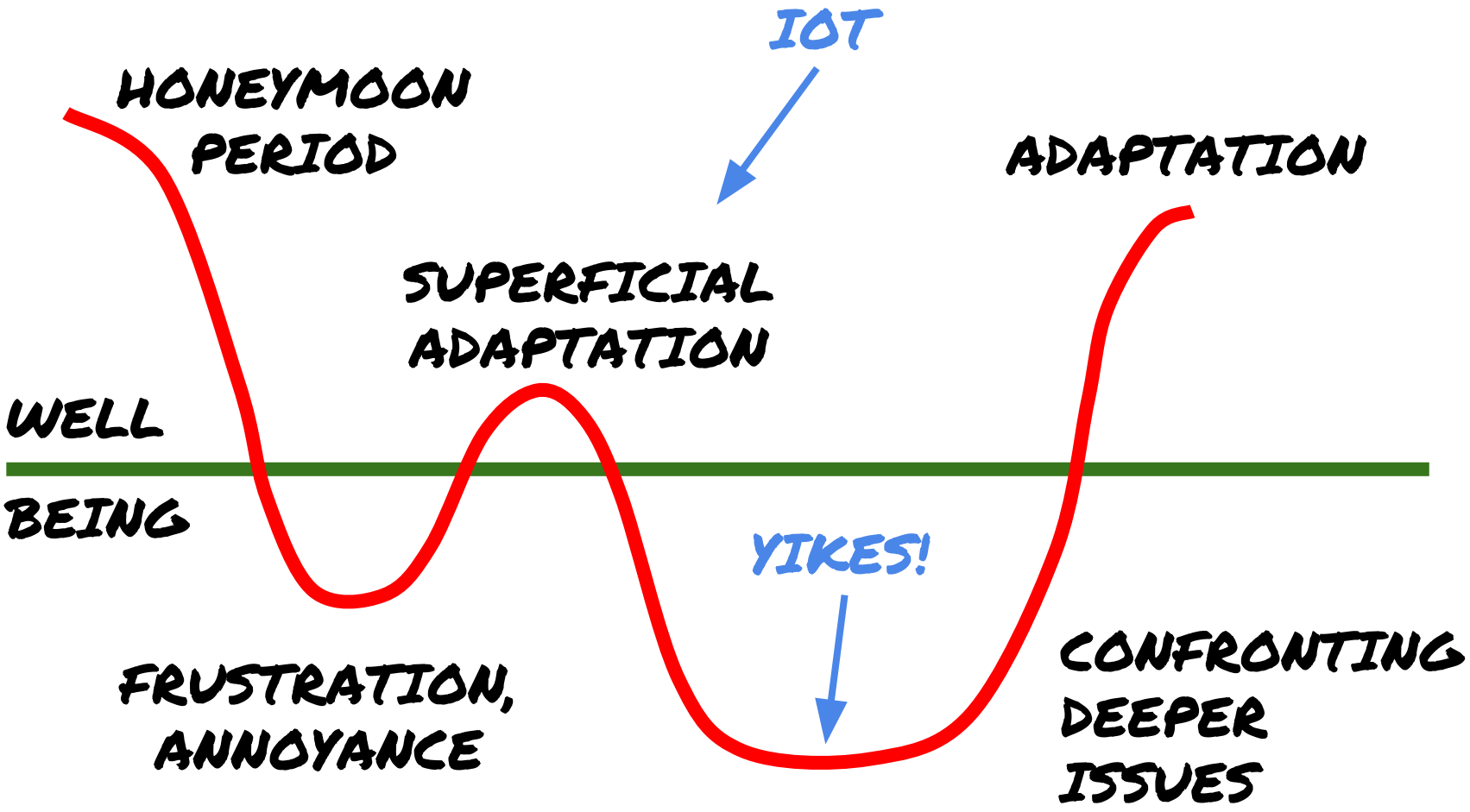

29%
70
ecobee


nest
Your thermostat has been disconnected from the network for 1 day.
OK
@WoelAJilliams


9:41 AM
100%
Results
Today at 8:14 am
Hair Health
See Graph
65
%
YOUR HAIR IS FRAGILE
DAMAGE
High
BREAKAGE
Medium
TANGLING
Low
DRYNESS
Medium
withings
KÉRASTASE

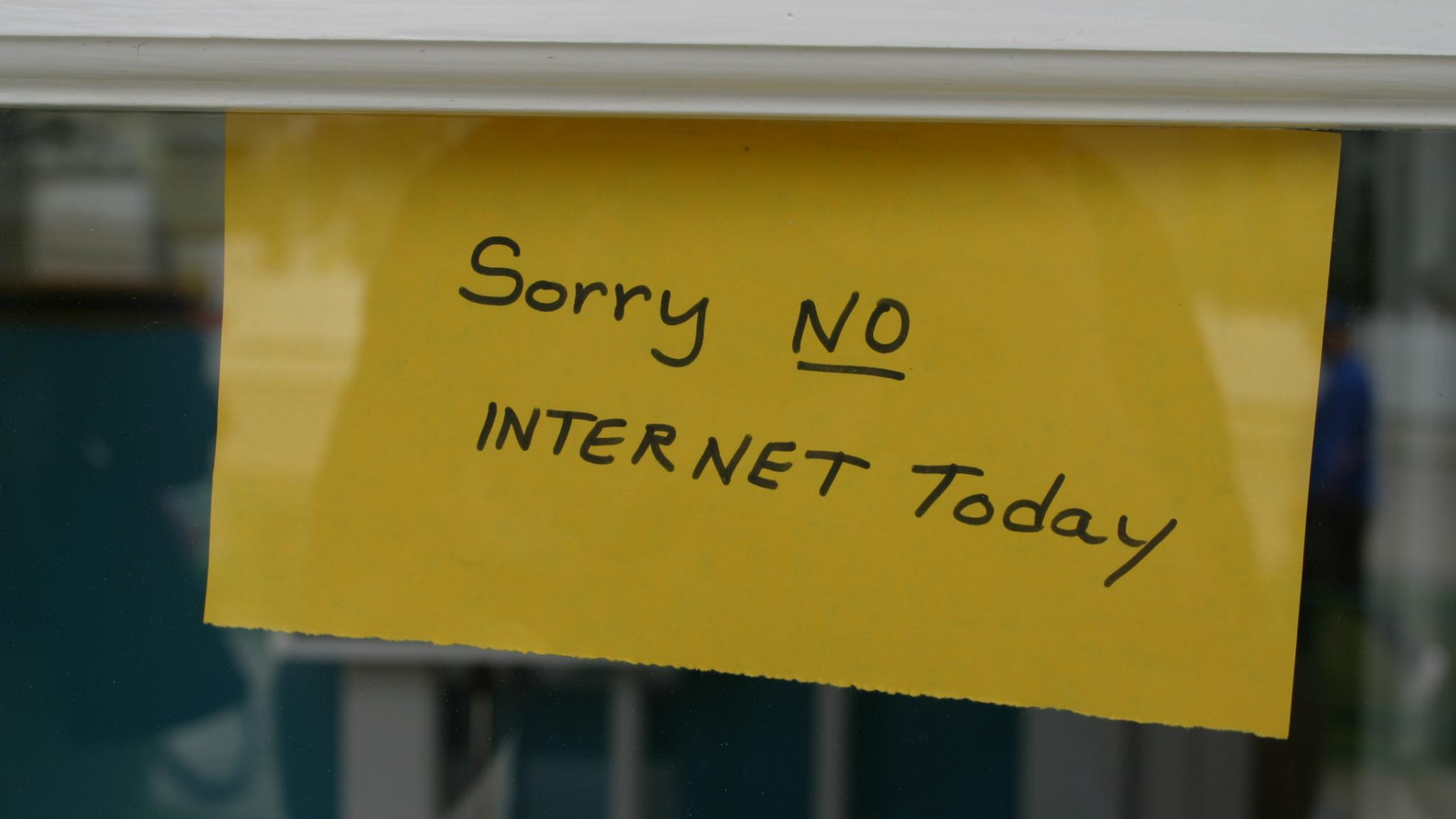

HONEYMOON PERIOD
ADAPTATION
SUPERFICIAL ADAPTATION
WELL BEING
FRUSTRATION, ANNOYANCE
CONFRONTING DEEPER ISSUES


IOT
HONEYMOON PERIOD
ADAPTATION
SUPERFICIAL ADAPTATION
WELL BEING
FRUSTRATION, ANNOYANCE
CONFRONTING DEEPER ISSUES


IOT
HONEYMOON PERIOD
ADAPTATION
SUPERFICIAL ADAPTATION
WELL BEING
YIKES!
FRUSTRATION, ANNOYANCE
CONFRONTING DEEPER ISSUES

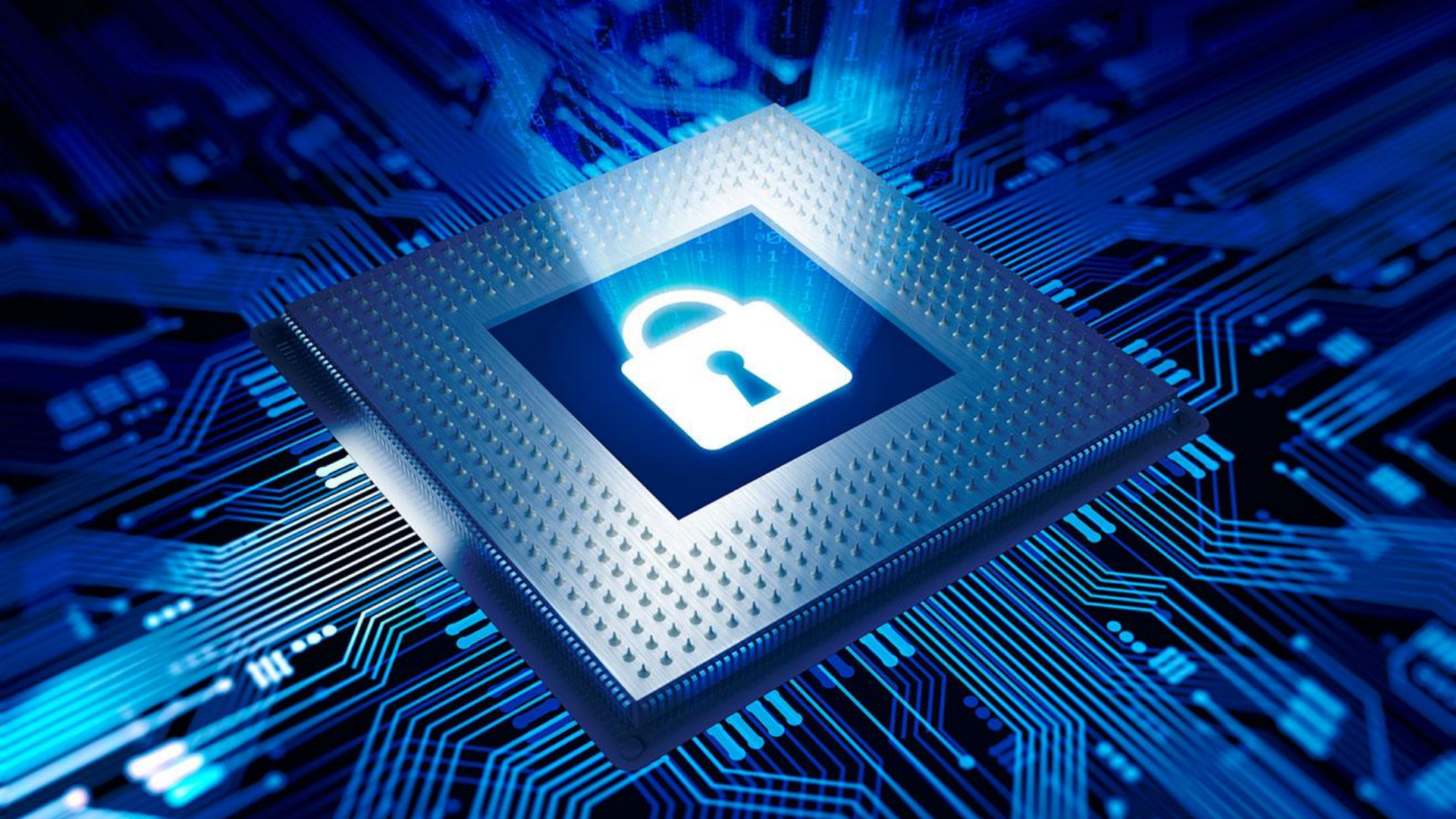
Hardware

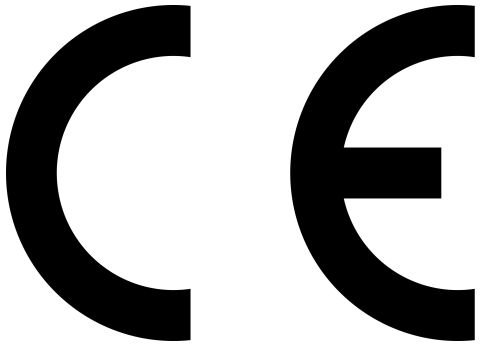
When “in the field” is a field.


Sorry NO
INTERNET Today


17
13


update
shift






ETT HUNDRA KRO
FÖR SVERIGE I TIDEN
2000
KRONOR

20cm

90m

60m

1.5km

10km

35km

Global

2002	**Bluetooth 1.2**	Signal strength indicator, speed up to 721 kbit/sec
2004	**Bluetooth 2.0**	Transfer rates up to 3 Mbit/sec
2007	**Bluetooth 2.1**	Improved pairing experience, reduced power consumption
2009	**Bluetooth 3.0**	High-speed (24 Mbit/sec), alternative transport (802.11)
2010	**Bluetooth 4.0**	Low power profile (coin battery), simple device discovery
2013	**Bluetooth 4.1**	Fast data advertising, dual mode topology (802.11n)
2014	**Bluetooth 4.2**	IoT emphasis, support for IPv6 connectivity


Service
Heart Rate Service
Characteristic
Heart Rate Measurement
Characteristic
Body Sensor Location
Generic Attribute Profile

UUID

(16 bytes)

Brand

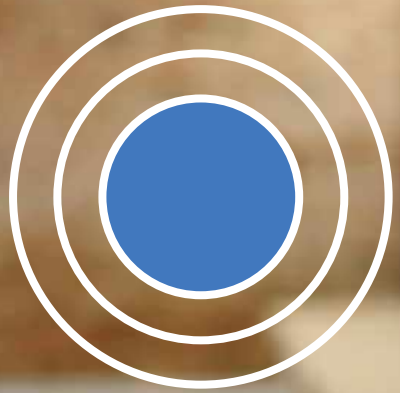
Major

(2 bytes)

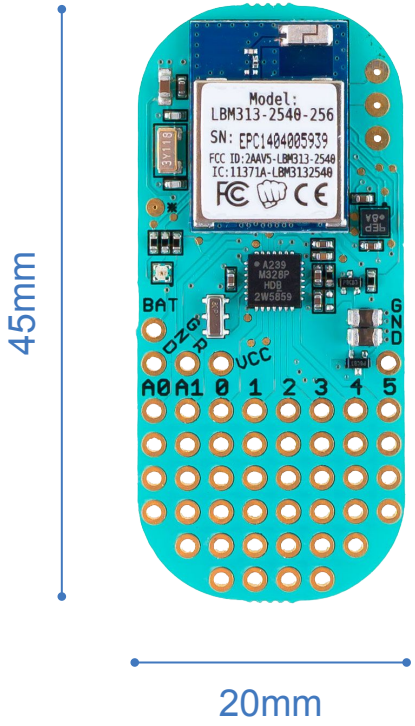
Store

Minor

(2 bytes)



Shelf



Name: Light Blue Bean

Size: 21 x 46mm

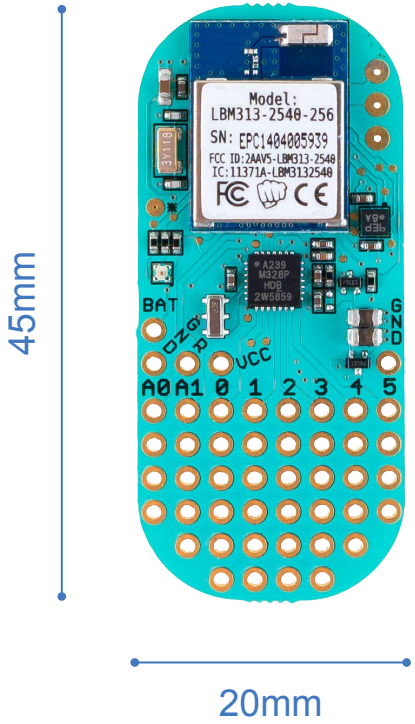
GPIO: 8 mixed-signal

CPU: ATmega328p, CC254x

Bluetooth

Memory: 32kb flash, 2kb RAM

Power: Coin cell operation



Internet: Device pairing (BLE)

Tooling: Arduino, iOS, Android, Node.js

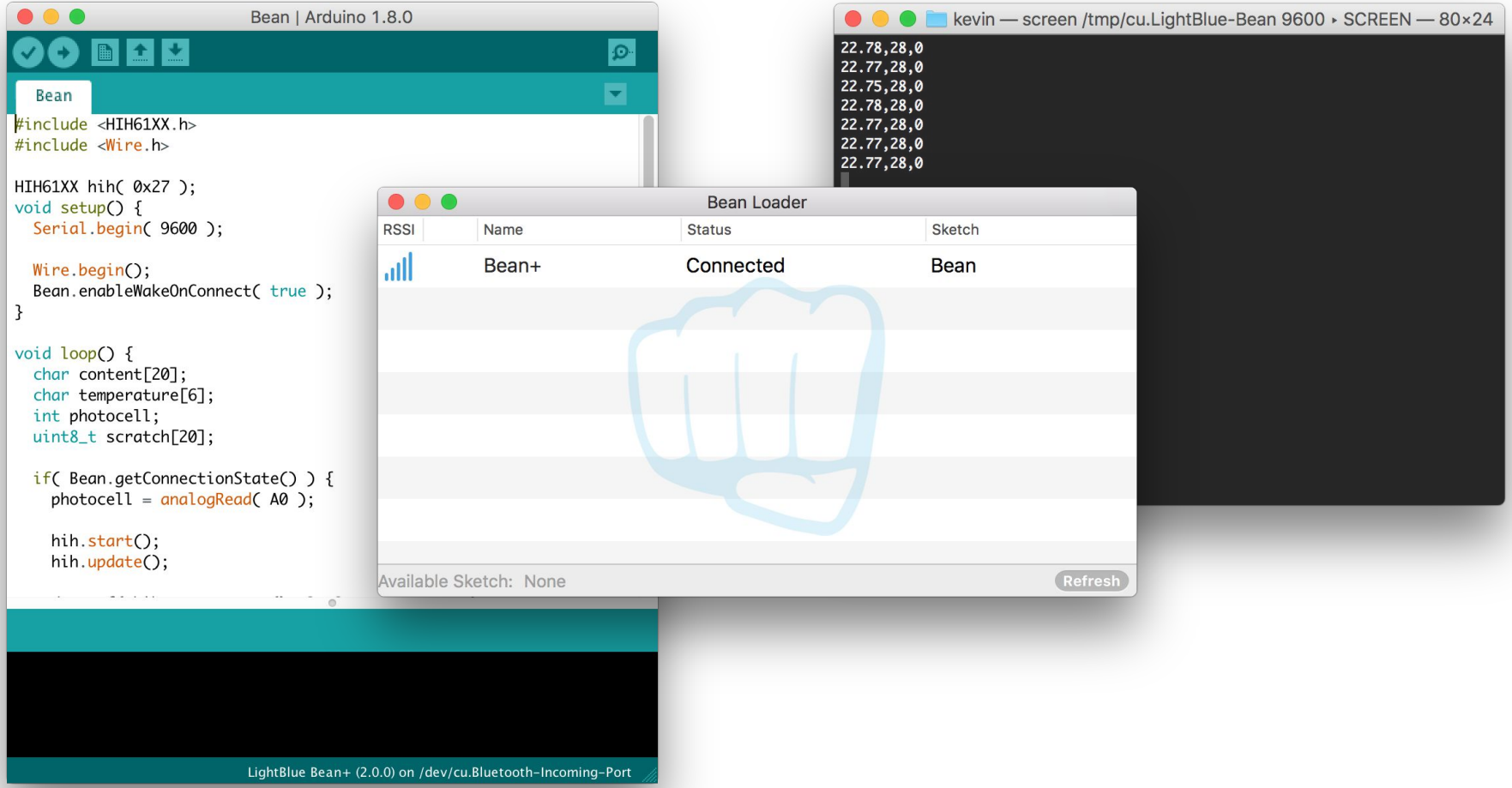
Production: Pre-programmed units, SoC

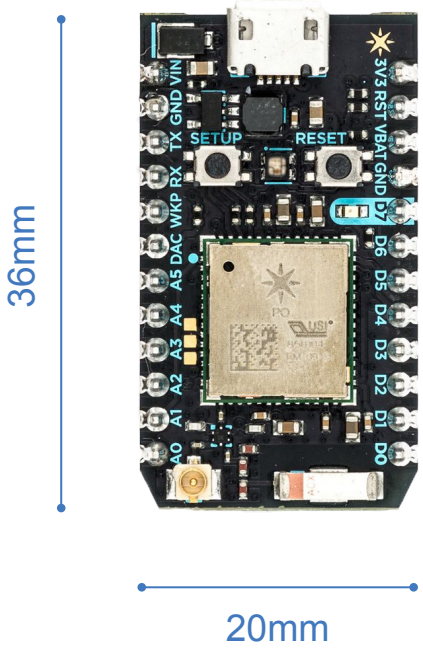
Updates: Cloud, BLE

Extras: Accelerometer, RGB LED

Certifications: FCC, CE


Model:
LBM313-2540-256
SN: EPC1404005939
FCC ID:2AAV5-LBM313-2540
IC:11371A-LBM3132540
BAT
GND
VCC
A0 A1 0 1 2 3 4 5
BACtrack
AT&T
9:50 PM
41%
Your result:
0.02
You are experiencing slight alcohol intoxication.
Learn more about this BAC result
OK
VISA
THE NORTH FACE


Bean | Arduino 1.8.0
Bean
#include <HIH61XX.h>
#include <Wire.h>
HIH61XX hih(0x27);
void setup() {
Serial.begin(9600);
Wire.begin();
Bean.enableWakeOnConnect(true);
}
void loop() {
char content[20];
char temperature[6];
int photocell;
uint8_t scratch[20];
if(Bean.getConnectionState()) {
photocell = analogRead(A0);
hih.start();
hih.update();
LightBlue Bean+ (2.0.0) on /dev/cu.Bluetooth-Incoming-Port
kevin — screen /tmp/cu.LightBlue-Bean 9600 ▸ SCREEN — 80×24
22.78,28,0
22.77,28,0
22.75,28,0
22.78,28,0
22.77,28,0
22.77,28,0
22.77,28,0
Bean Loader
RSSI
Name
Status
Sketch
Bean+
Connected
Bean
Available Sketch: None
Refresh



Name: Particle Photon

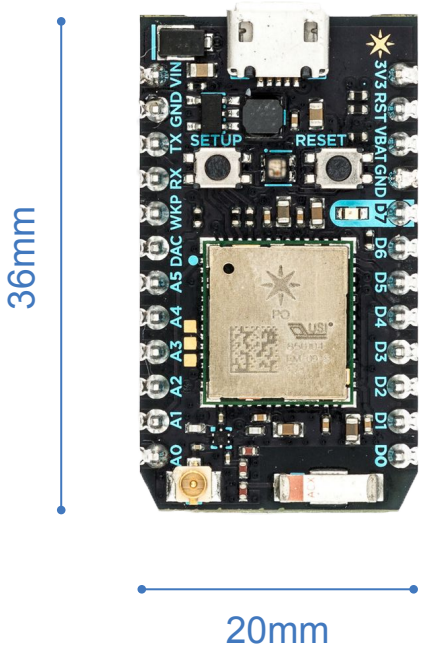
Size: 20 x 28mm

GPIO: 18 mixed-signal

CPU: ARM M3 (120MHz)

Memory: 1Mb flash, 128kb RAM

Power: 3.3V, 3.2uA deep sleep



Internet: Soft AP, component exposure

Tooling: Web and Atom-based, C/C++

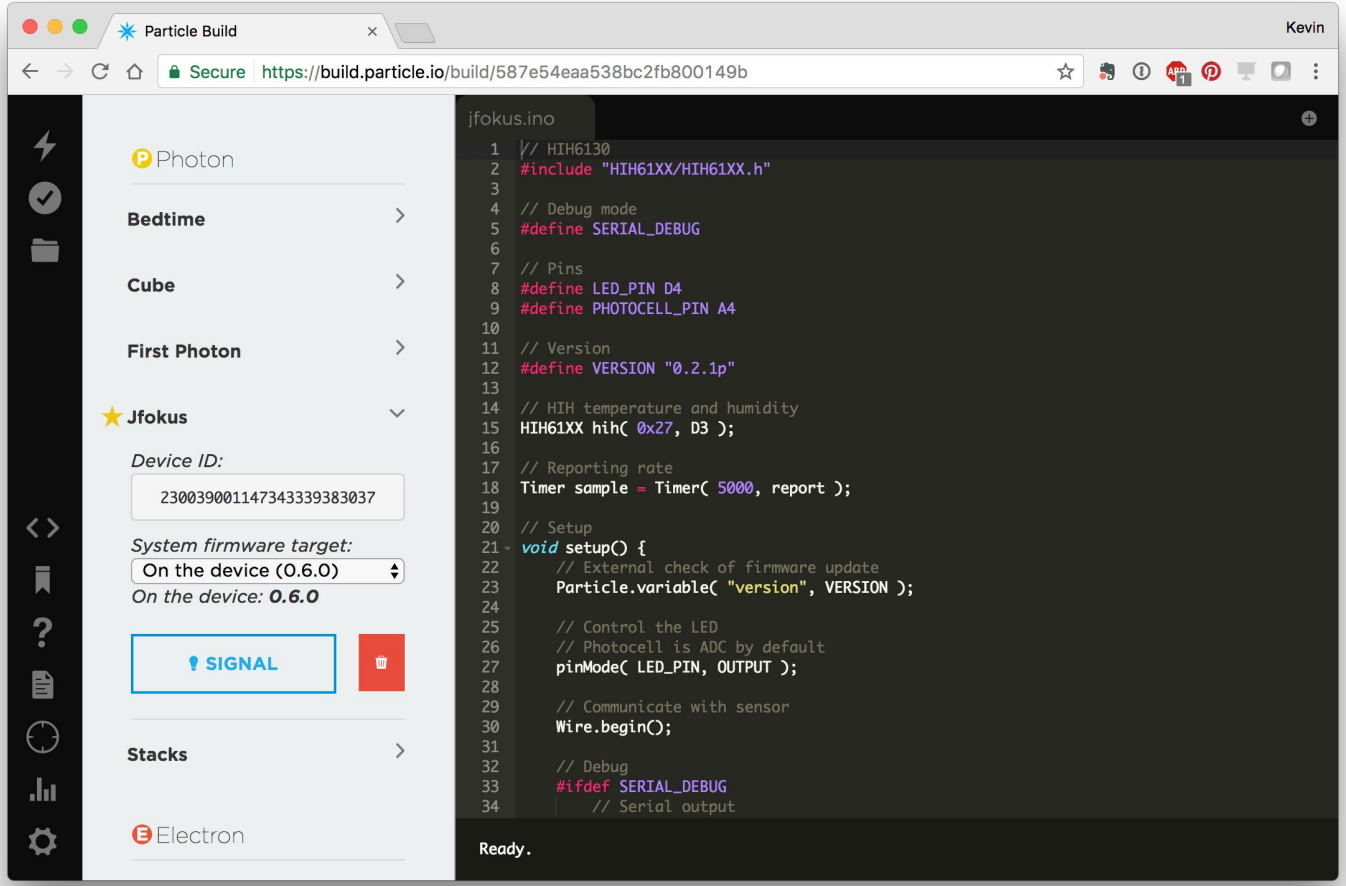
Production: Machine, prefabricated board

Updates: RTOS and application logic

Security: None on-board, remote functions

Certifications: FCC, CE, RTOS


3V3 RST VBAT GND D7
TX GND VIN
SETUP
RESET
RX
WKP
DAC
A5
A4
A3
A2
A1
A0
D6
D5
D4
D3
D2
D1
D0
DONUT SHOP
GREEN MOUNTAIN COFFEE
Breakfast Blend
LIGHT ROAST COFFEE
1


Particle Build
Kevin
Secure
https://build.particle.io/build/587e54eaa538bc2fb800149b
Photon
Bedtime
Cube
First Photon
Jfokus
Device ID:
230039001147343339383037
System firmware target:
On the device (0.6.0)
On the device: 0.6.0
SIGNAL
Stacks
Electron
jfokus.ino
// HIH6130
#include "HIH61XX/HIH61XX.h"
// Debug mode
#define SERIAL_DEBUG
// Pins
#define LED_PIN D4
#define PHOTOCELL_PIN A4
// Version
#define VERSION "0.2.1p"
// HIH temperature and humidity
HIH61XX hih(0x27, D3);
// Reporting rate
Timer sample = Timer(5000, report);
// Setup
void setup() {
// External check of firmware update
Particle.variable("version", VERSION);
// Control the LED
// Photocell is ADC by default
pinMode(LED_PIN, OUTPUT);
// Communicate with sensor
Wire.begin();
// Debug
#ifdef SERIAL_DEBUG
// Serial output
Ready.

Name: Electric Imp

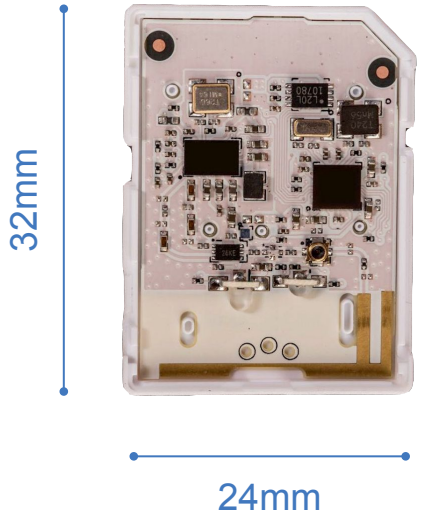
Size: 10 x 7.9mm

GPIO: 23 mixed-signal

CPU: ARM M4F (144MHz)

Memory: 130kb (application)

Power: 3.3V, 6uA deep sleep



Internet: BlinkUp, component exposure

Tooling: Web-based IDE, Squirrel

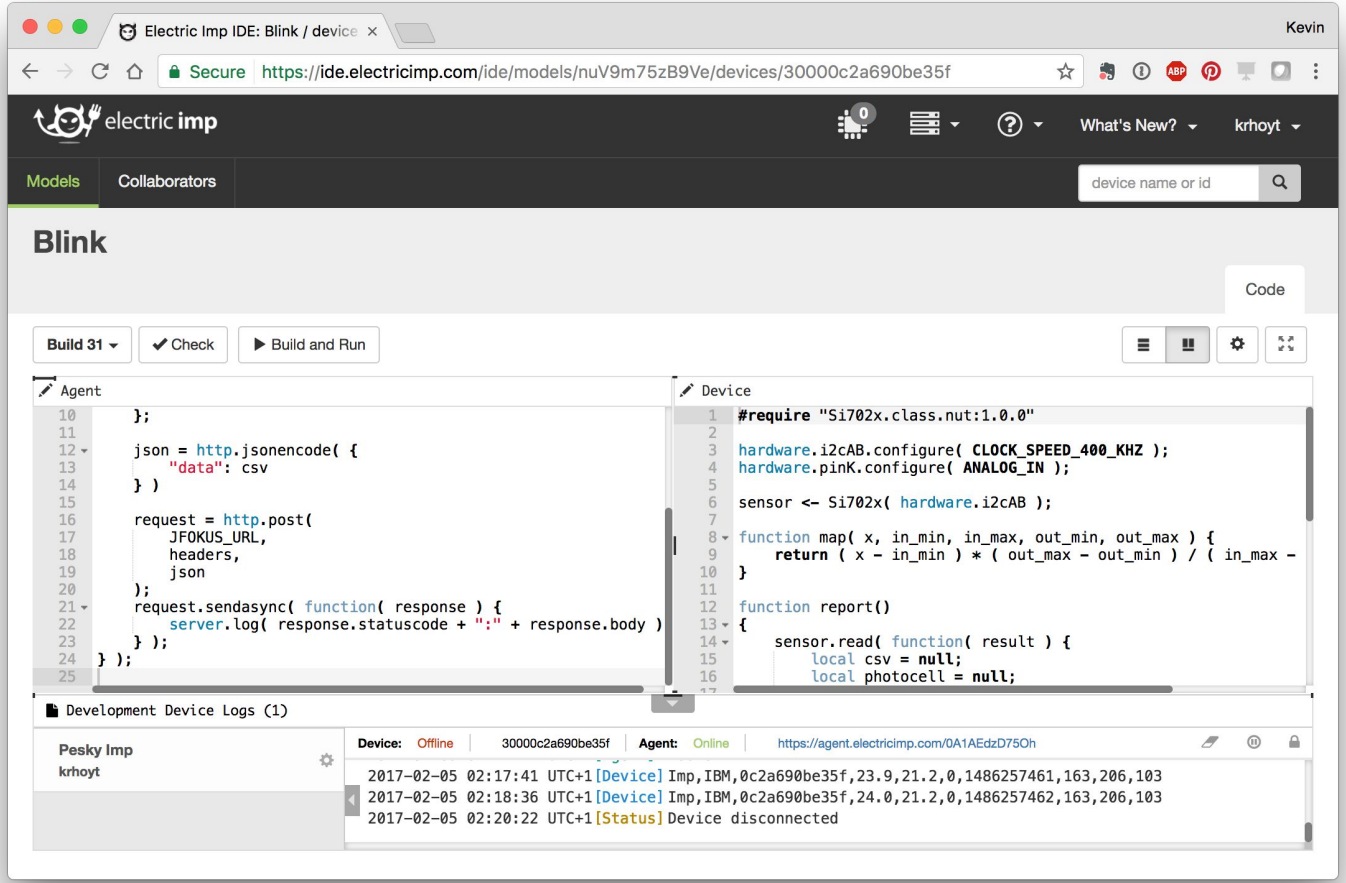
Production: Machine, SD card, third-party

Updates: RTOS and application logic

Security: On-board cryptography, agents

Certifications: FCC, CE, ROHS


Pitney Bowes Small Office Series
mailstation 2
Review
Enter
Class
Funds
Menu
Clear/Back
Space
Shift


Electric Imp IDE: Blink / device
Kevin
Secure https://ide.electricimp.com/ide/models/nuV9m75zB9Ve/devices/30000c2a690be35f
electric imp
What's New?
krhoyt
Models
Collaborators
device name or id
Blink
Code
Build 31
Check
Build and Run
Agent
10 };
11
12 json = http.jsonencode({
13 "data": csv
14 })
15
16 request = http.post(
17 JFOKUS_URL,
18 headers,
19 json
20);
21 request.sendasync(function(response) {
22 server.log(response.statuscode + ":" + response.body)
23 });
24 });
25
Device
1 #require "Si702x.class.nut:1.0.0"
2
3 hardware.i2cAB.configure(CLOCK_SPEED_400_KHZ);
4 hardware.pinK.configure(ANALOG_IN);
5
6 sensor <- Si702x(hardware.i2cAB);
7
8 function map(x, in_min, in_max, out_min, out_max) {
9 return (x - in_min) * (out_max - out_min) / (in_max -
10 }
11
12 function report()
13 {
14 sensor.read(function(result) {
15 local csv = null;
16 local photocell = null;
Development Device Logs (1)
Pesky Imp
krhoyt
Device: Offline
30000c2a690be35f
Agent: Online
https://agent.electricimp.com/0A1AEdzD75Oh
2017-02-05 02:17:41 UTC+1 [Device] Imp,IBM,0c2a690be35f,23.9,21.2,0,1486257461,163,206,103
2017-02-05 02:18:36 UTC+1 [Device] Imp,IBM,0c2a690be35f,24.0,21.2,0,1486257462,163,206,103
2017-02-05 02:20:22 UTC+1 [Status] Device disconnected

Name: Particle Electron

Size: 20 x 52mm

GPIO: 30 mixed-signal

CPU: ARM M3 (120MHz)

Memory: 1Mb flash, 128kb RAM

Power: 3.3V, 130uA deep sleep

Internet: No pairing, M2M/industrial

Tooling: Online, Atom-based IDE, C/C++

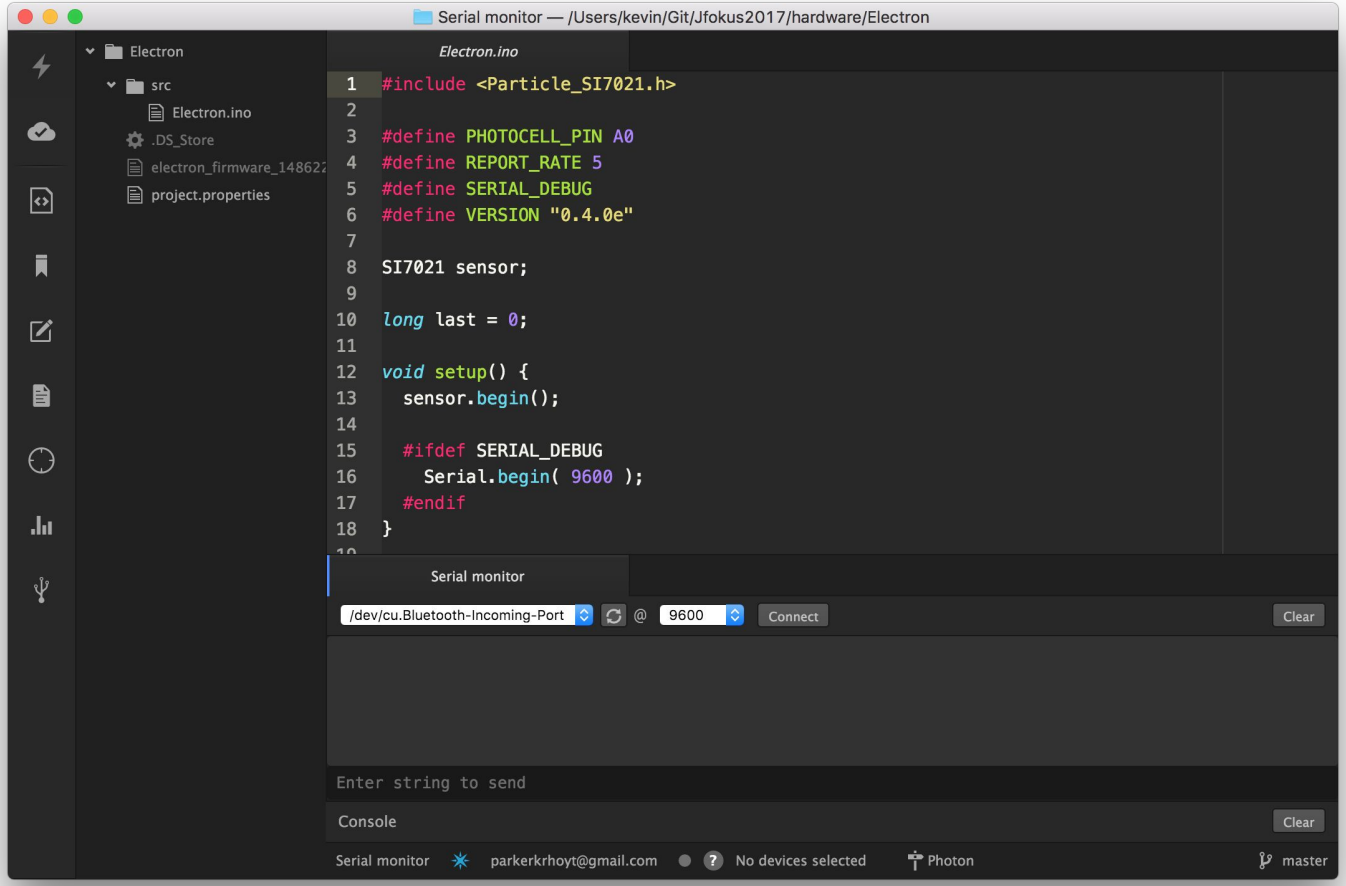
Production: Offered only as board

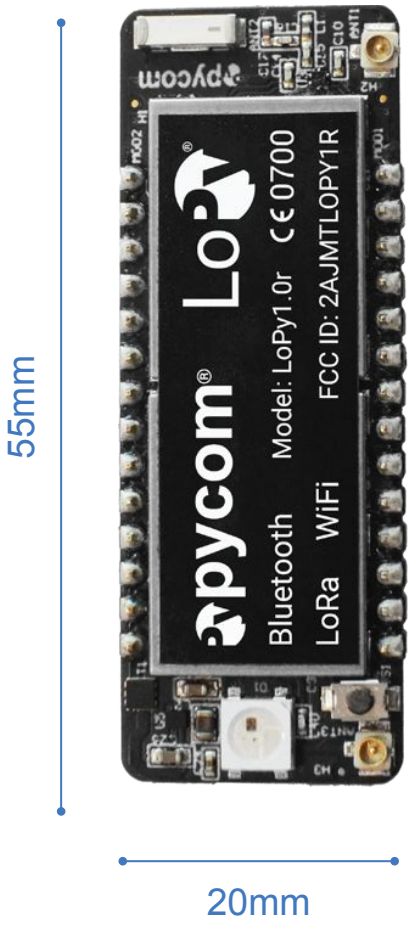
Updates: RTOS and application logic

Security: None on-board, remote functions

Certifications: FCC, CE, ROHS

3V3 RST VBAT GND D13 D12 D11
A11 A12 A13 RX TX GND VIN
SETUP
RST
ublox
Model: SARA-U260
830000.0404.000
IMEI: 352252060748325
13 14/36
00S-00
FCC ID: XPYSARAU260
IC: 8595A-SARAU260
Made in Austria


Serial monitor — /Users/kevin/Git/Jfokus2017/hardware/Electron
Electron
src
Electron.ino
.DS_Store
electron_firmware_14862
project.properties
Electron.ino
#include <Particle_SI7021.h>
#define PHOTOCELL_PIN A0
#define REPORT_RATE 5
#define SERIAL_DEBUG
#define VERSION "0.4.0e"
SI7021 sensor;
long last = 0;
void setup() {
sensor.begin();
#ifdef SERIAL_DEBUG
Serial.begin(9600);
#endif
}
Serial monitor
/dev/cu.Bluetooth-Incoming-Port
@
9600
Connect
Clear
Enter string to send
Console
Clear
Serial monitor
parkerkrhoyt@gmail.com
No devices selected
Photon
master



Internet: Gateway access for nodes

Tooling: Pymakr IDE, Pymate mobile

Production: OEM modules, board

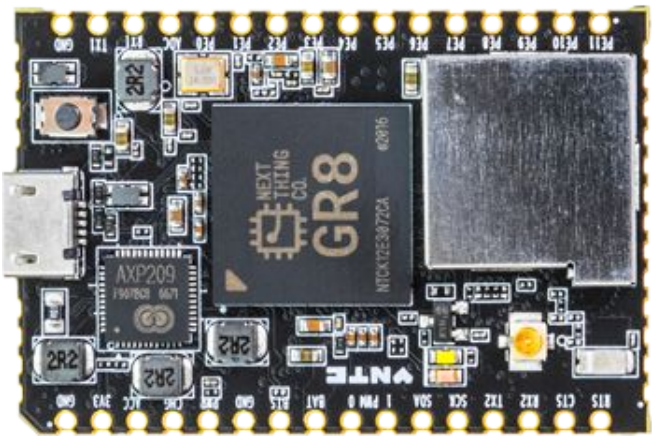
Updates: Pybytes Platform

Security: SSL/TLS, WPA Enterprise, hash

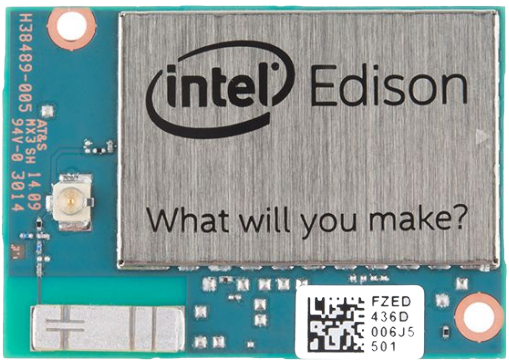
Certifications: FCC, CE

pycom
Bluetooth
Model: LoPy1.0r
CE 0700
LoRa
WiFi
FCC ID: 2AJMTLOPY1R


Raspberry Pi 3 Model B V1.2
© Raspberry Pi 2015
GPIO
Made in the UK


GR8
NEXT THING CO.
AXP209
VNTE


Omega 2
Model:OM2-R1
FCC ID:TO-BE-DETERMINED
Designed by Onion Shenzhen
As part of Onion Invention Platform
Made in China
https://onion.io

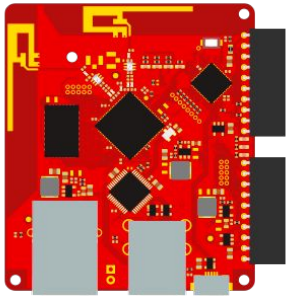

intel Edison
What will you make?
FZED
436D
006J5
501

25mm

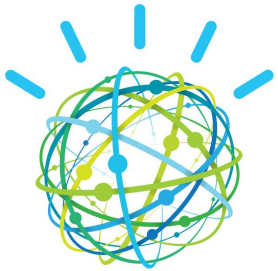
35mm

Software

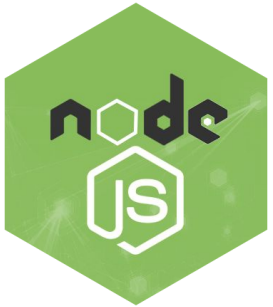
The IoT data storm is real.



MQTT

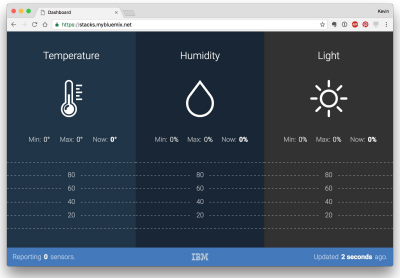


MQTT



WebSocket

HTTPS

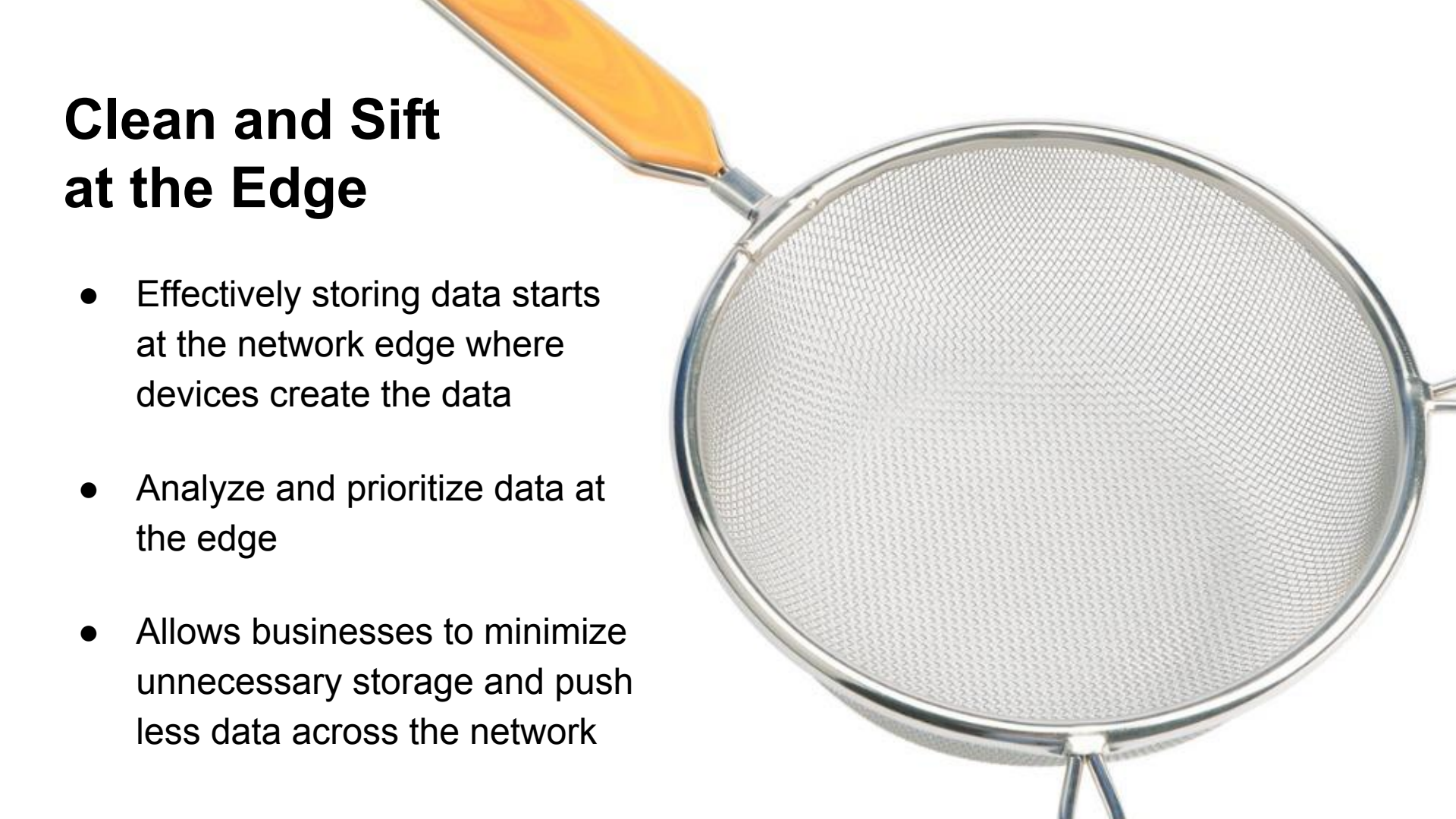


Get Picky

- Operational and real-time use cases keep data for 30 to 90 days
- Manufacturing uses cases for 12+ months
- Oil and gas use cases for several years
- Sift through historical data to find product failures and maintenance costs

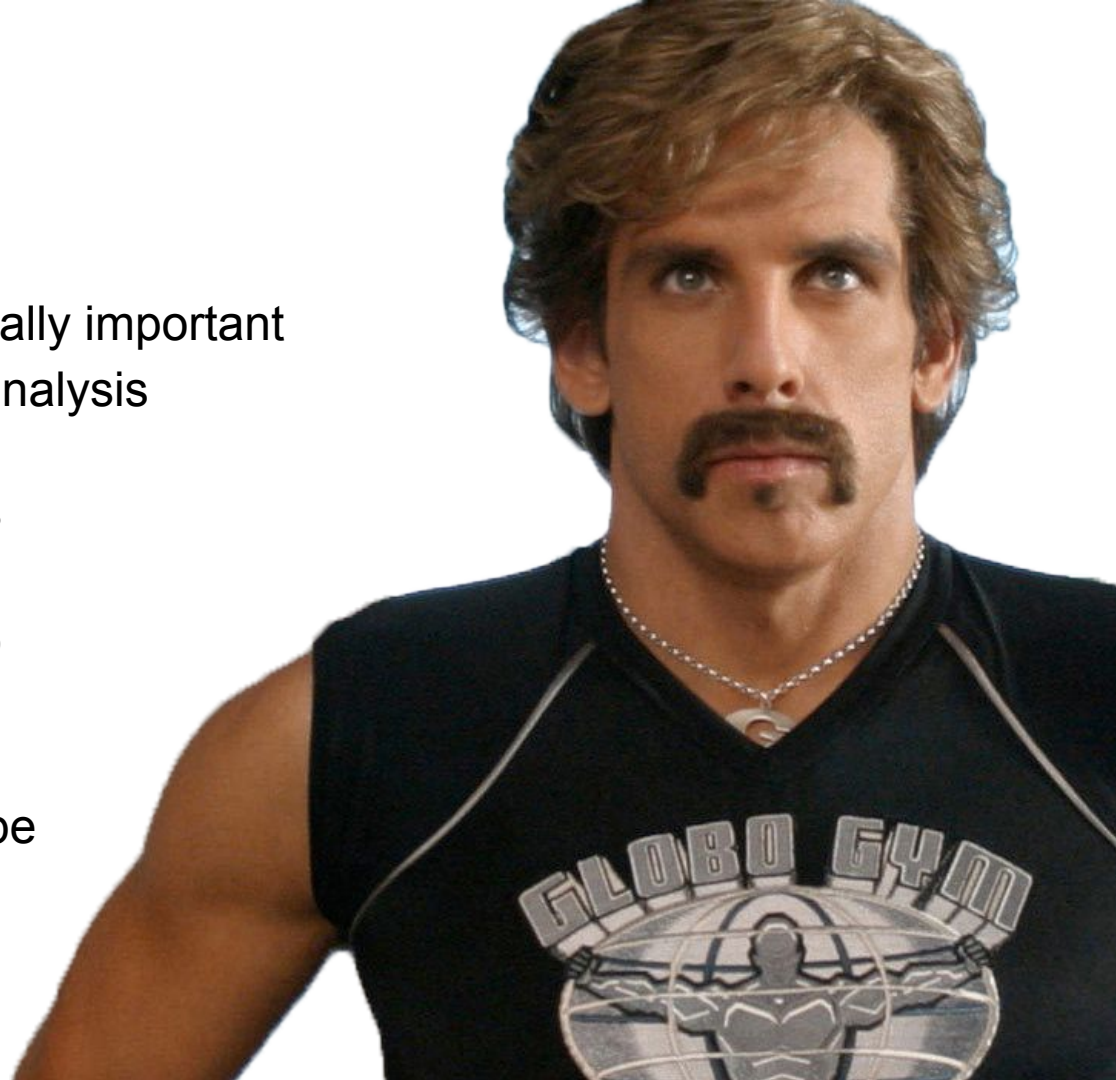
Clean and Sift at the Edge

- Effectively storing data starts at the network edge where devices create the data
- Analyze and prioritize data at the edge
- Allows businesses to minimize unnecessary storage and push less data across the network



Avoid Averaging

- Data that is deemed strategically important should stay whole for better analysis
- Avoid aggregation at all costs
- Always strive for full fidelity to the raw data
- If you average data, you will be an average corporation



Use a Storage Hierarchy

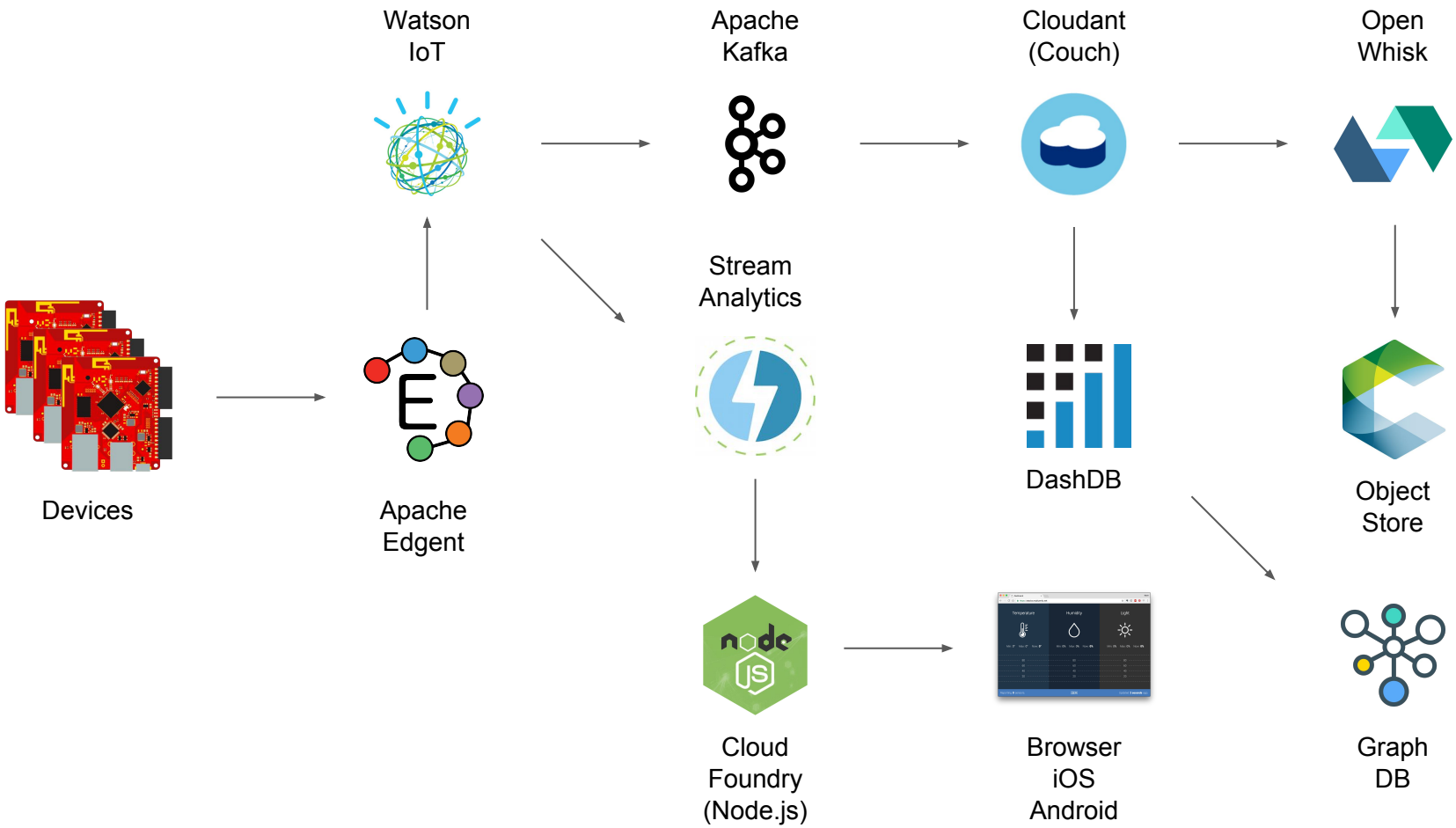
- Not all sensor data is created equally
- Some data must be analyzed immediately for real-time feedback, while other data is archival in nature
- Hot, warm, and cold data
  - Enterprise storage
  - HDFS storage for analytics
  - Cloud block storage
  - Cloud cold storage

Think Temporal Compression

- IoT data is often about slight changes from one reading to the next
- Consider storing the changes between the data instead of the full reading
- Columnar database compression may yield 8X reduction in storage needs
- Temporal compression can yield 60X-80X reduction

Keep it in the Cloud

- IoT and Cloud are made for one another
- Few organizations have the ability to accommodate IoT-scale data in on-premise data centers
- The cloud can scale up or down as devices are added or removed
- If your IoT data strategy does not have cloud at the center - you are doing it wrong


Watson
IoT
Apache
Kafka
Cloudant
(Couch)
Open
Whisk
Stream
Analytics
Devices
Apache
Edgent
DashDB
Object
Store
Cloud
Foundry
(Node.js)
Browser
iOS
Android
Graph
DB

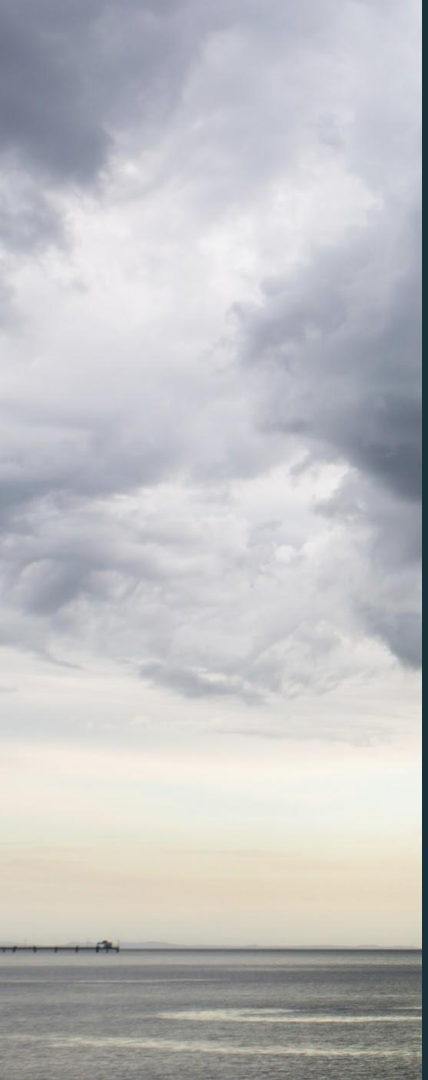
You

The rise of the machines.

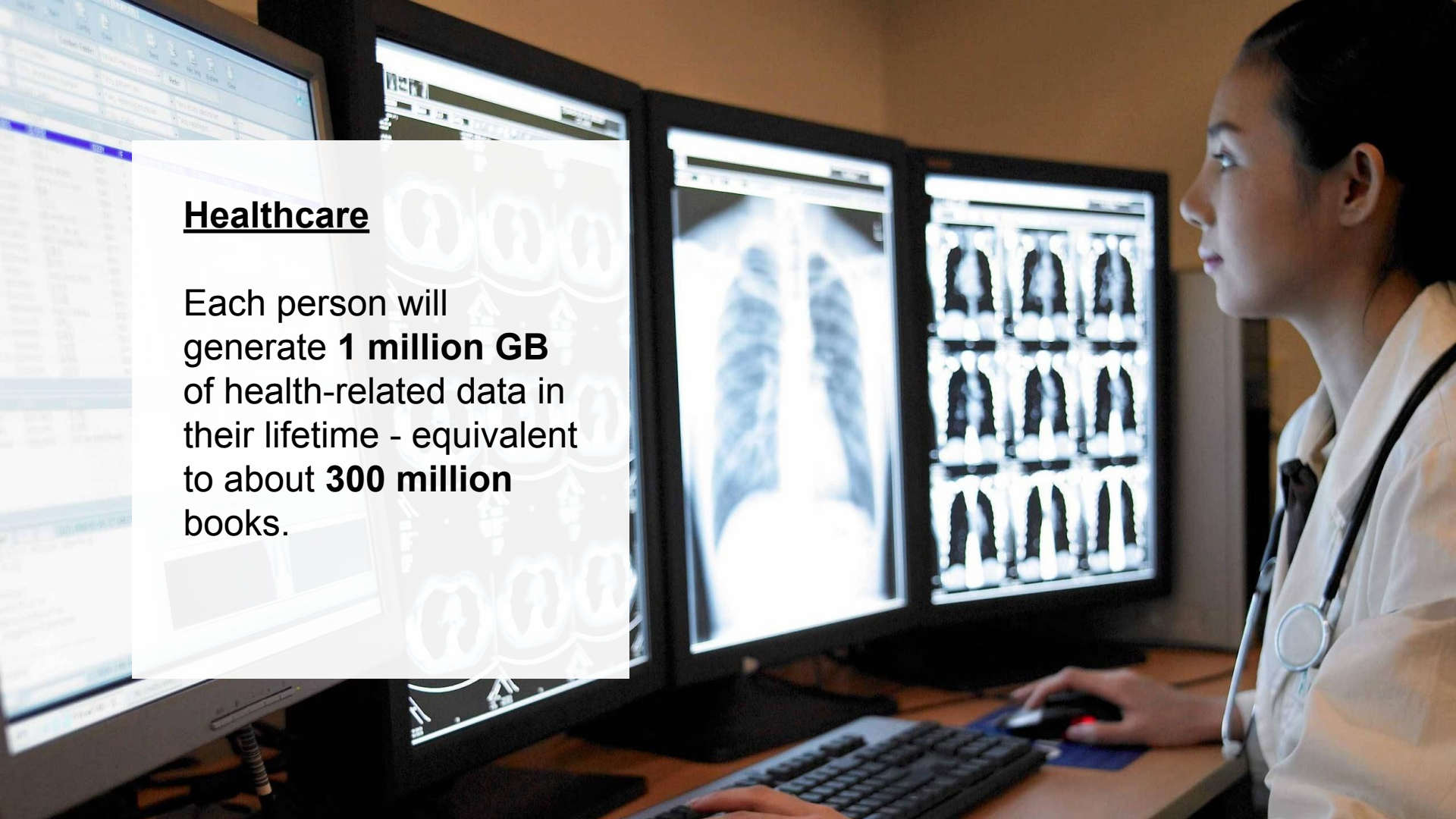
2.5 quintillion bytes of data created every day.

90% of the data in the world today has been created in the last **two years** alone.

Every minute **1.7 megabytes** of data is created for **every person** on the planet. **All 7.3 billion of us.**



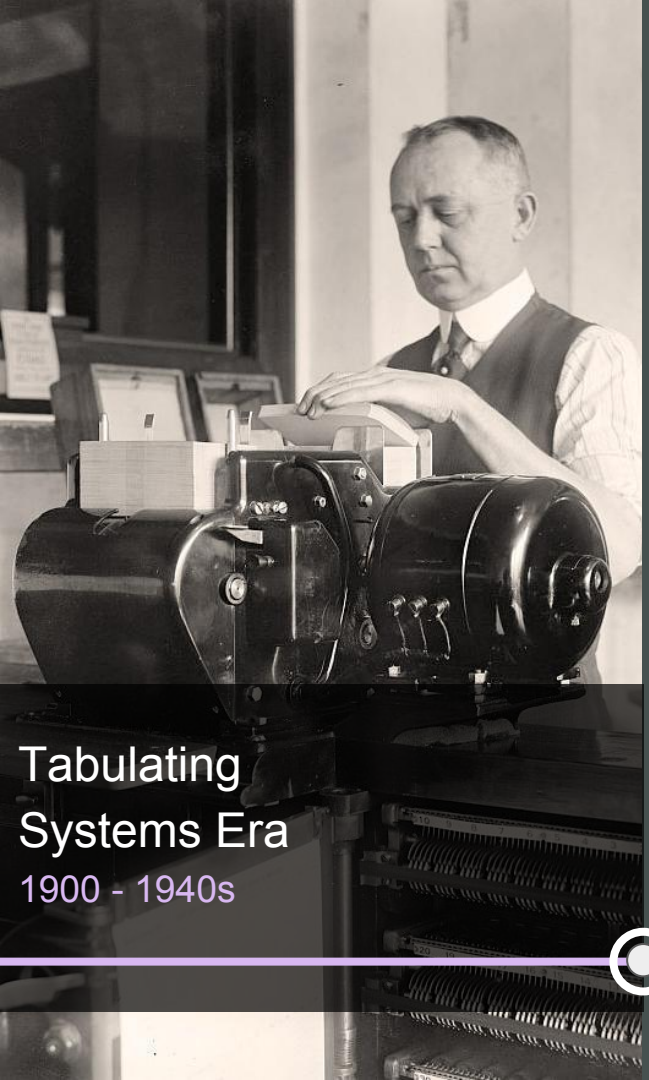
Unstructured data - “dark data” - accounts for 80% of all data generated today.



Healthcare

Each person will generate **1 million GB** of health-related data in their lifetime - equivalent to about **300 million** books.


NETFLIX

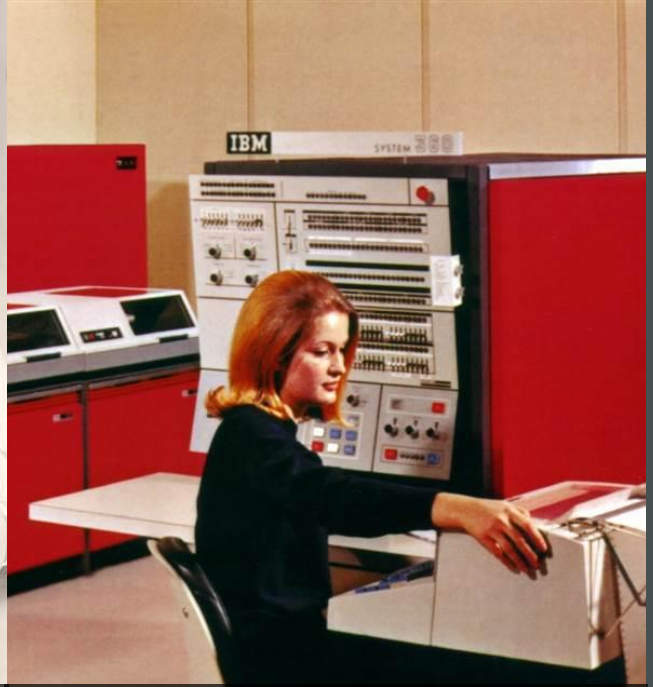


Tabulating Systems Era

1900 - 1940s

Tabulating Systems Era

1900 - 1940s



Programmable Systems Era

1950s - Present

Tabulating
Systems Era
1900 - 1940s

Programmable
Systems Era
1950s - Present

Cognitive
Computing Era
2011 -

Hardware: When “in the field” is a field, there is nothing quite as dangerous or complicated as simple connectivity.

Software: The IoT data storm is real. With the right storage strategy, the burden of IoT data can be greatly reduced.

You: In the future (15-30 years) programmers will not write code as much as they train machines.

Crossing the IoT Chasm

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