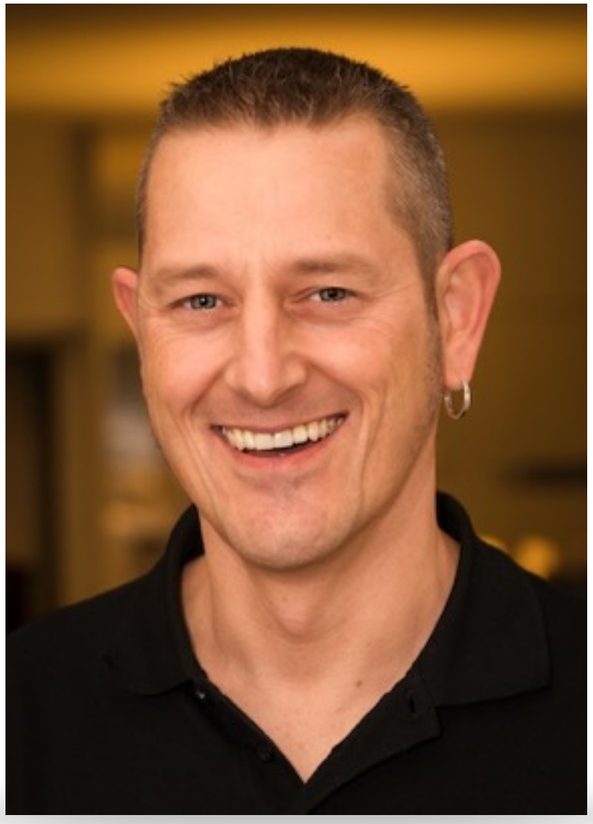
HEALTH CARE FOR THE ELDERLY USING IOT

ORACLE

ABOUT US



Gerrit Grunwald
Developer Evangelist
Oracle
@hansolo_

Safe Harbor Statement

The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, and timing of any features or functionality described for Oracle's products remains at the sole discretion of Oracle.

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IT'S

BEAUTIFUL

ORACLE

BUT...

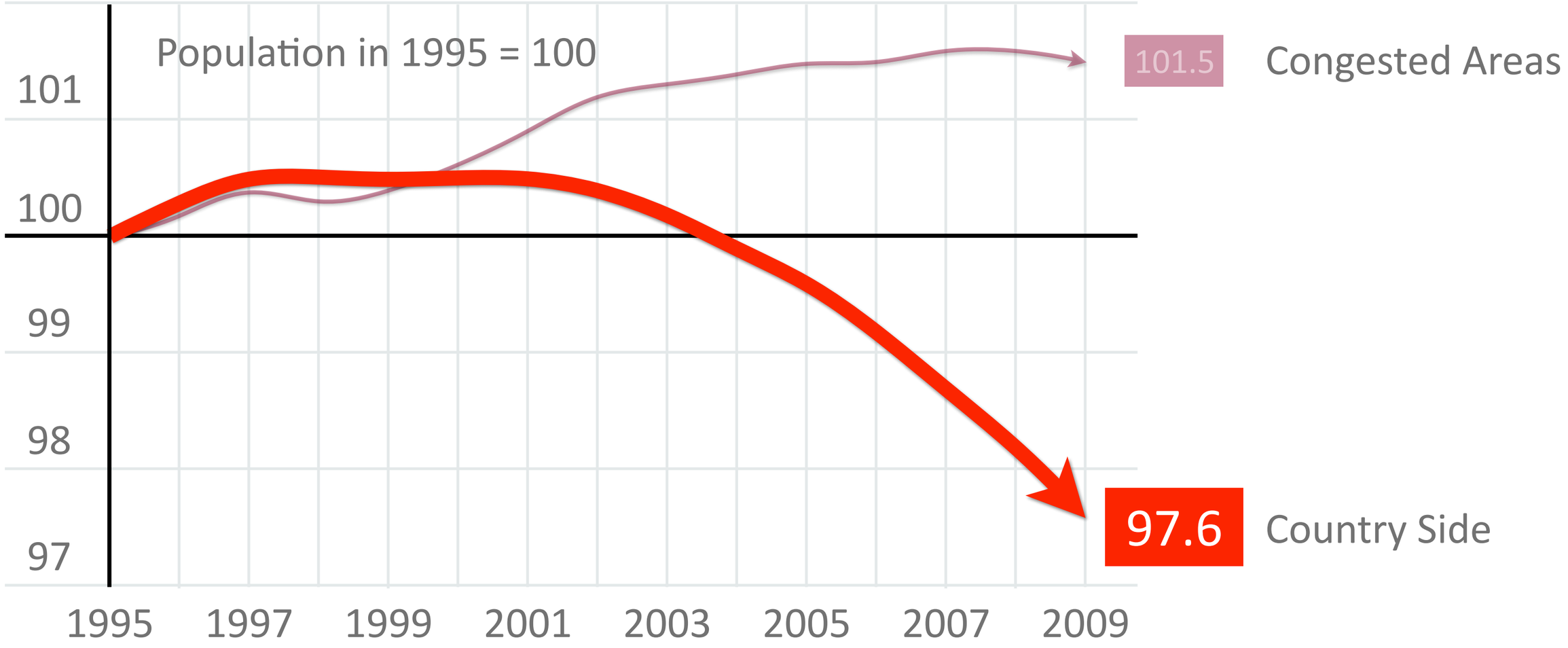
THERE ARE PROBLEMS

DEPOPULATION

DEPOPULATION

- Countryside less popular to people
- Young people moving to the cities
- People in general getting older

DEPOPULATION (e.g. GERMANY)



LESS

ACCESS

LESS ACCESS TO DOCTORS

- In rural areas half as many doctors
- Up to 5 times the distance to access health care services
- Fewer specialized health care services

AGING

DREAMS

ORACLE

OFTEN THE REALITY

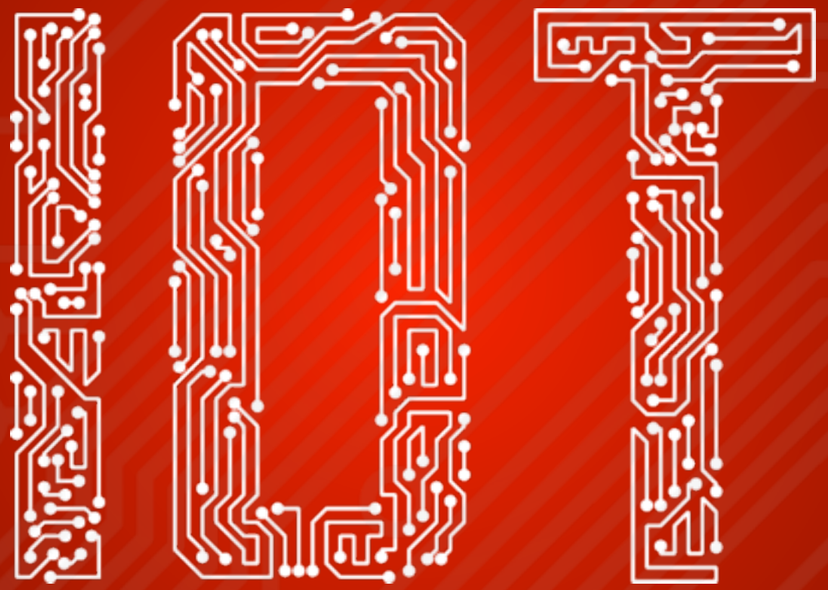
ORACLE

PEOPLE ARE ALONE

IN CASE OF NEED ?

ORACLE

ORACLE



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HEALTH

INDICATORS

ORACLE

HEALTH INDICATORS

- How many steps walked a day
- How often person changed rooms
- What locations have been visited
- How long the TV set was running
- …

HEALTH

ALERTS

HEALTH ALERTS

- Dramatic decrease of steps
- Dramatic decrease of room changes
- Alarm button was triggered
- Decrease of TV usage

HEALTH ALERTS

- Location outside doesn't change for longer period and it is night
- Location outside and bad weather (e.g. very cold, thunderstorm etc.)

HEALTH ALERTS

- and many many more…

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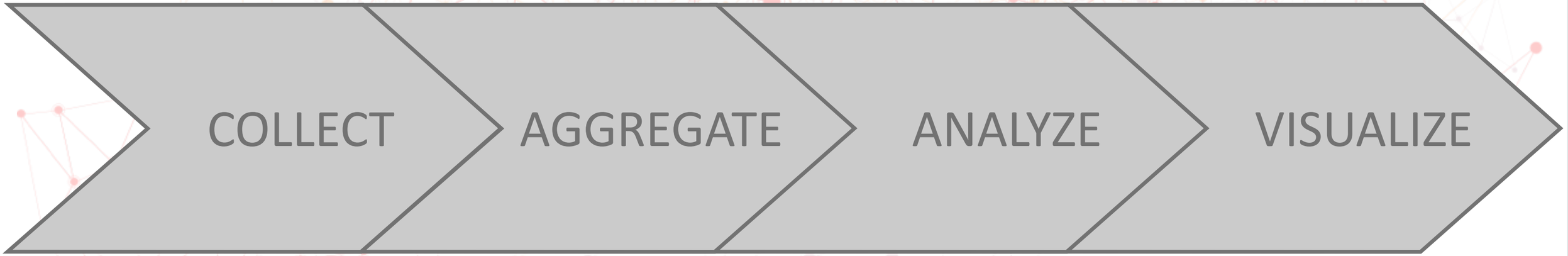
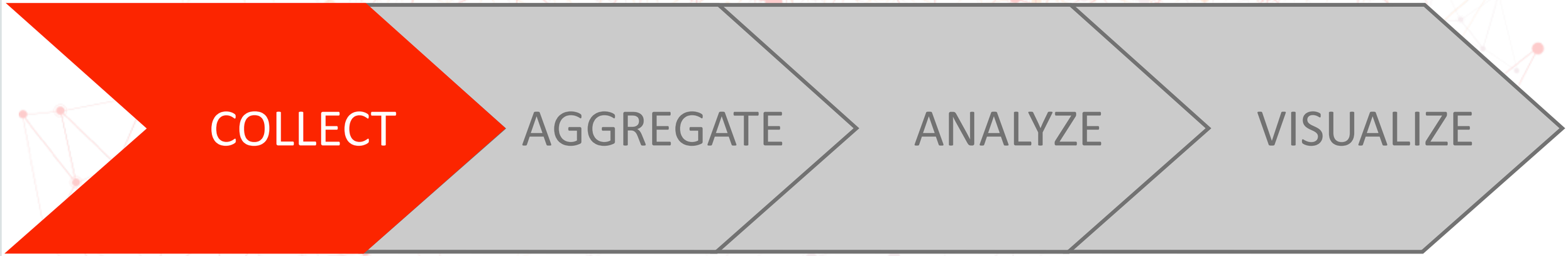
DATA PROCESSING



ORACLE

DATA PROCESSING



COLLECTING

HARDWARE REQUIREMENTS

HARDWARE REQUIREMENTS

- Internet connection is crucial
- iBeacons to locate current room
- Accelerometer to count steps
- GPS to locate person outside
- Powermeter to detect TV usage

IBEACONS

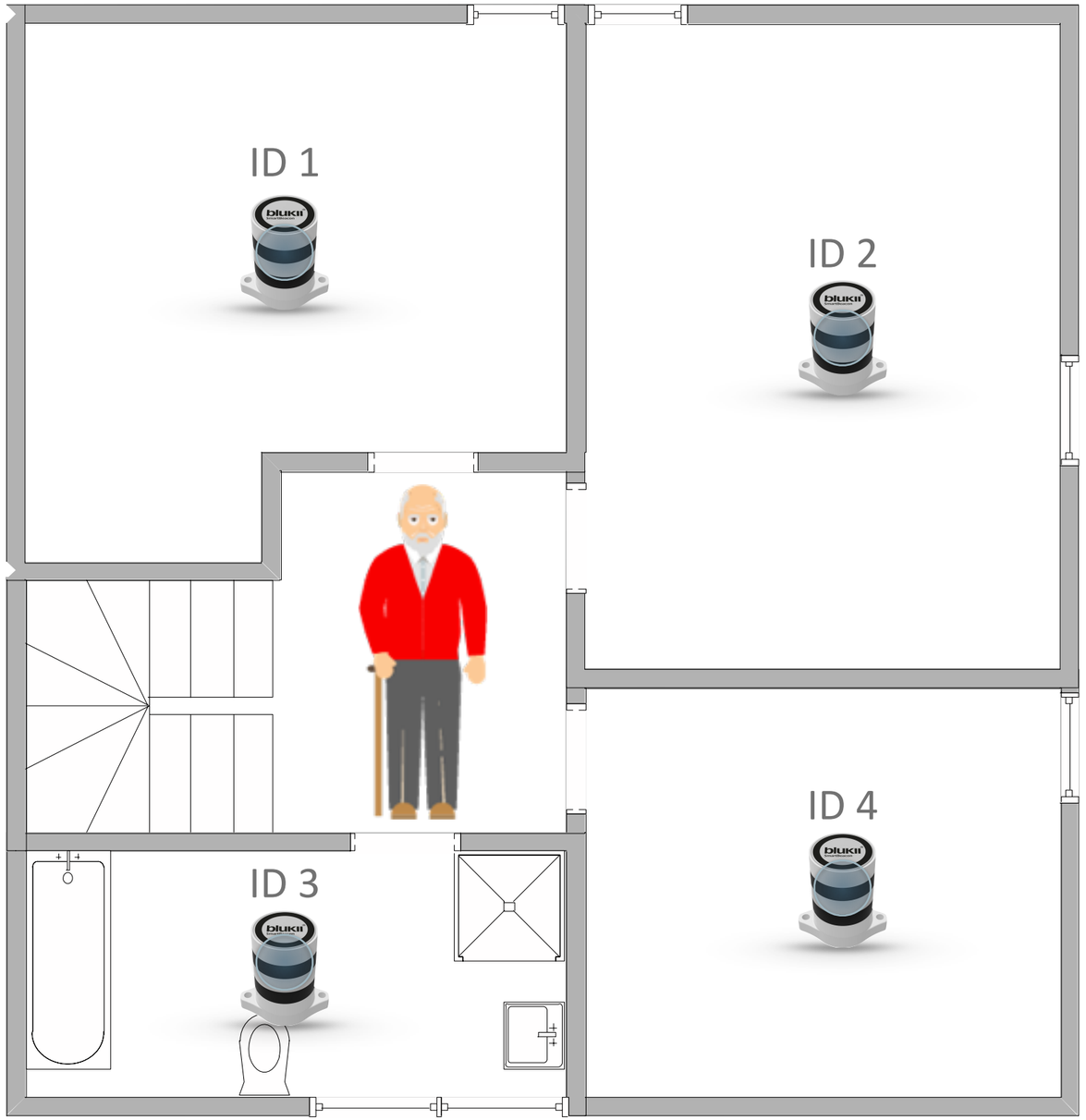
IBEACONS

IBEACONS

- Bluetooth Low Energy
- Broadcast unique ID
- Interval 0.1 - 10s
- Trigger location based action
- Useful for indoor navigation

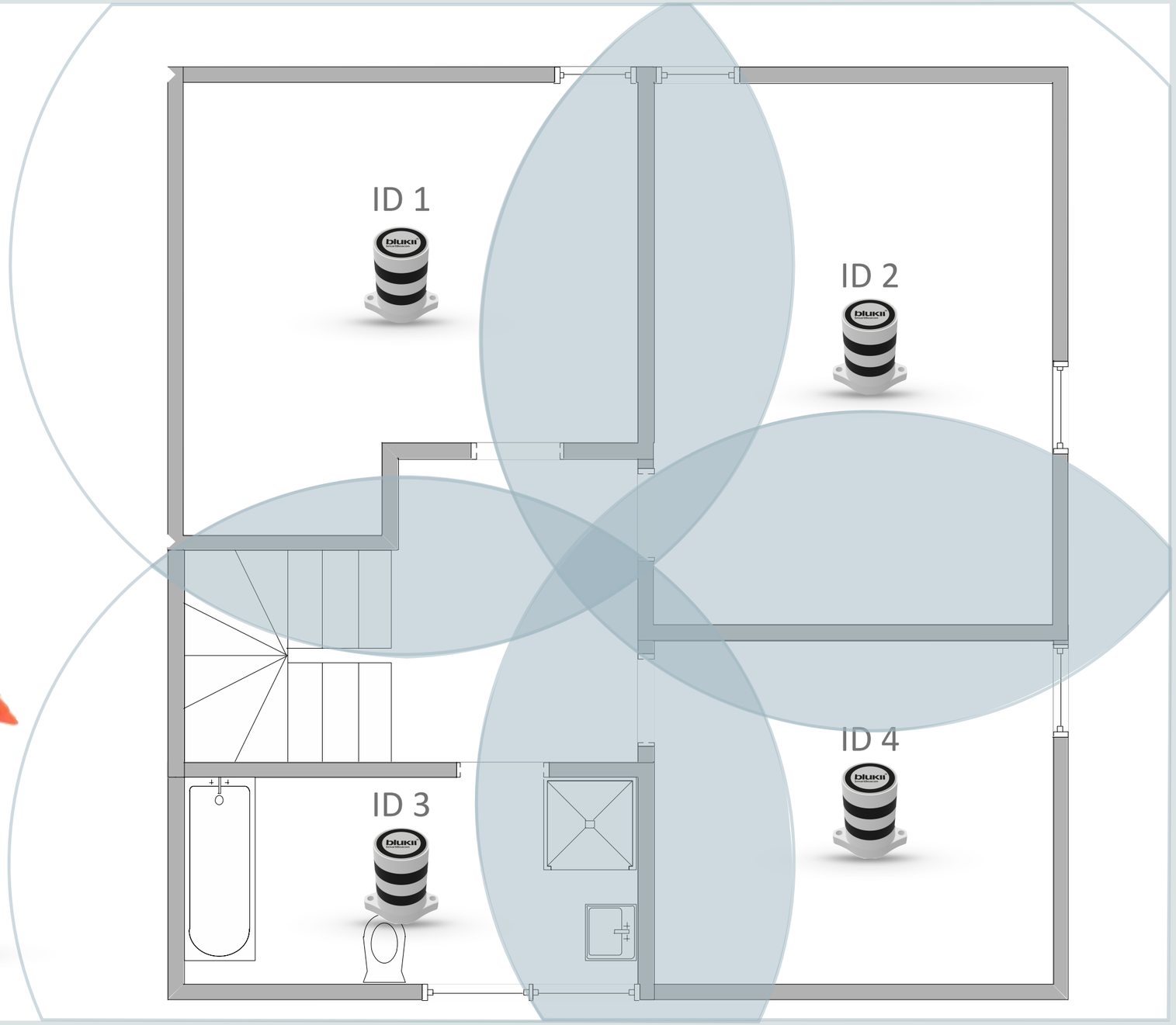
IBEACONS

Beacon detects beacon



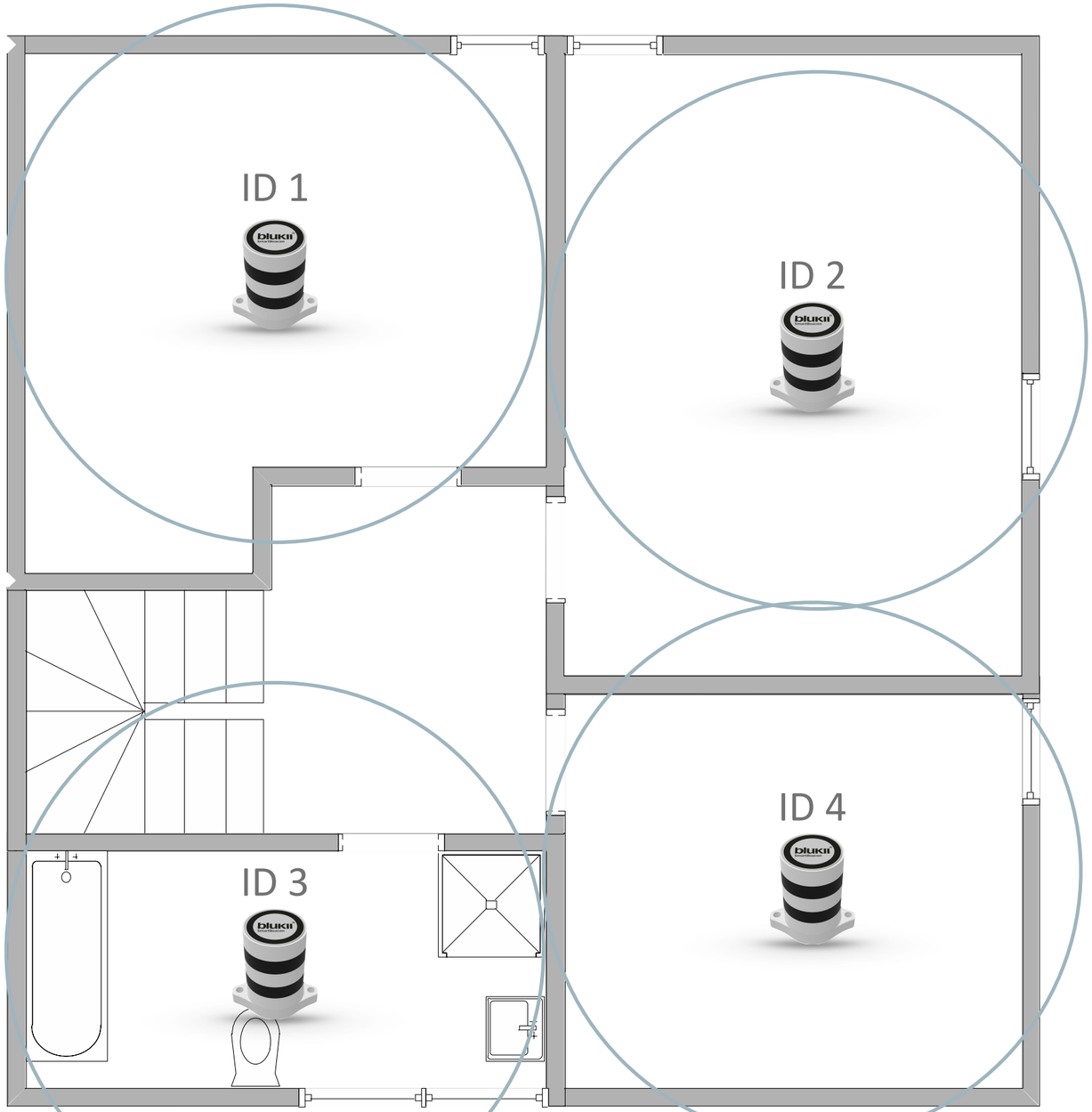
IBEACONS

TX Power to strong



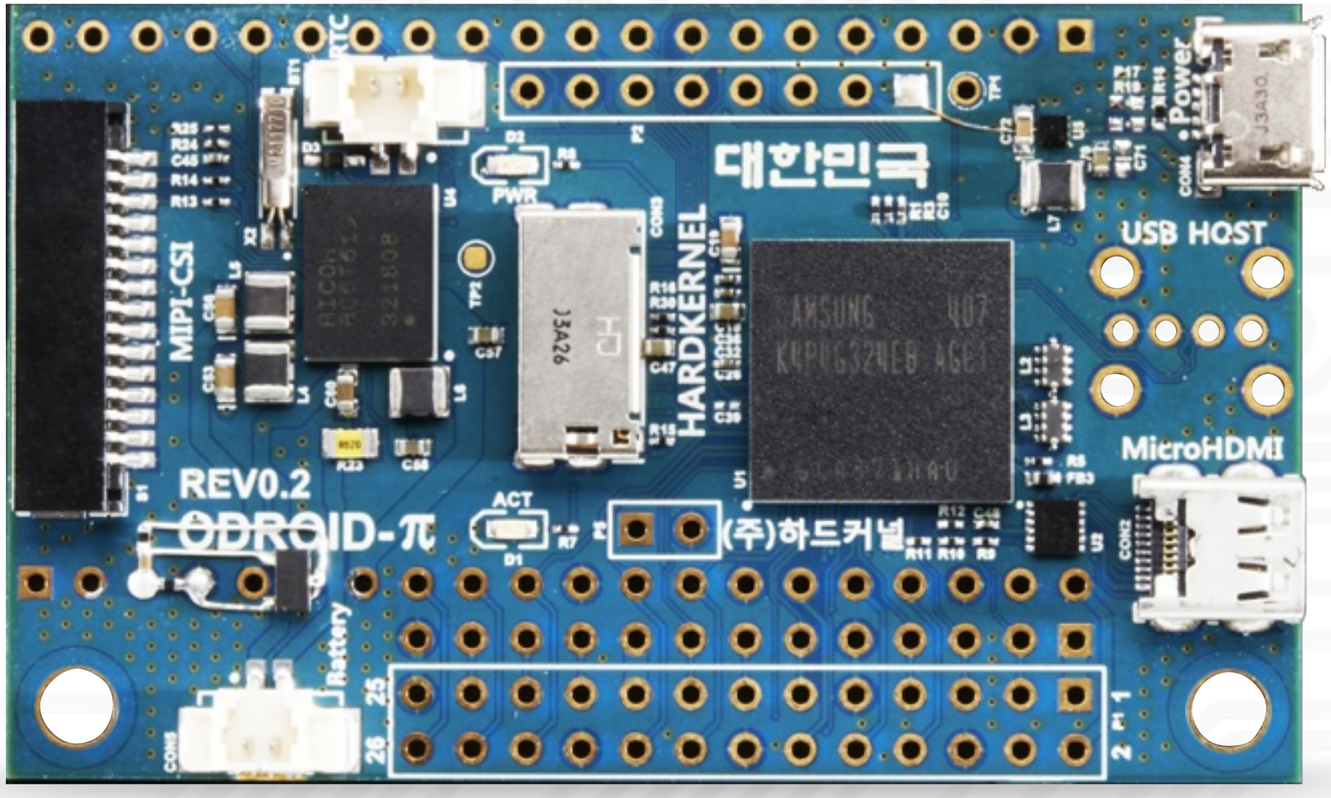
IBEACONS

TX Power less strong



1ST ATTEMPT

1ST ATTEMPT



1ST ATTEMPT

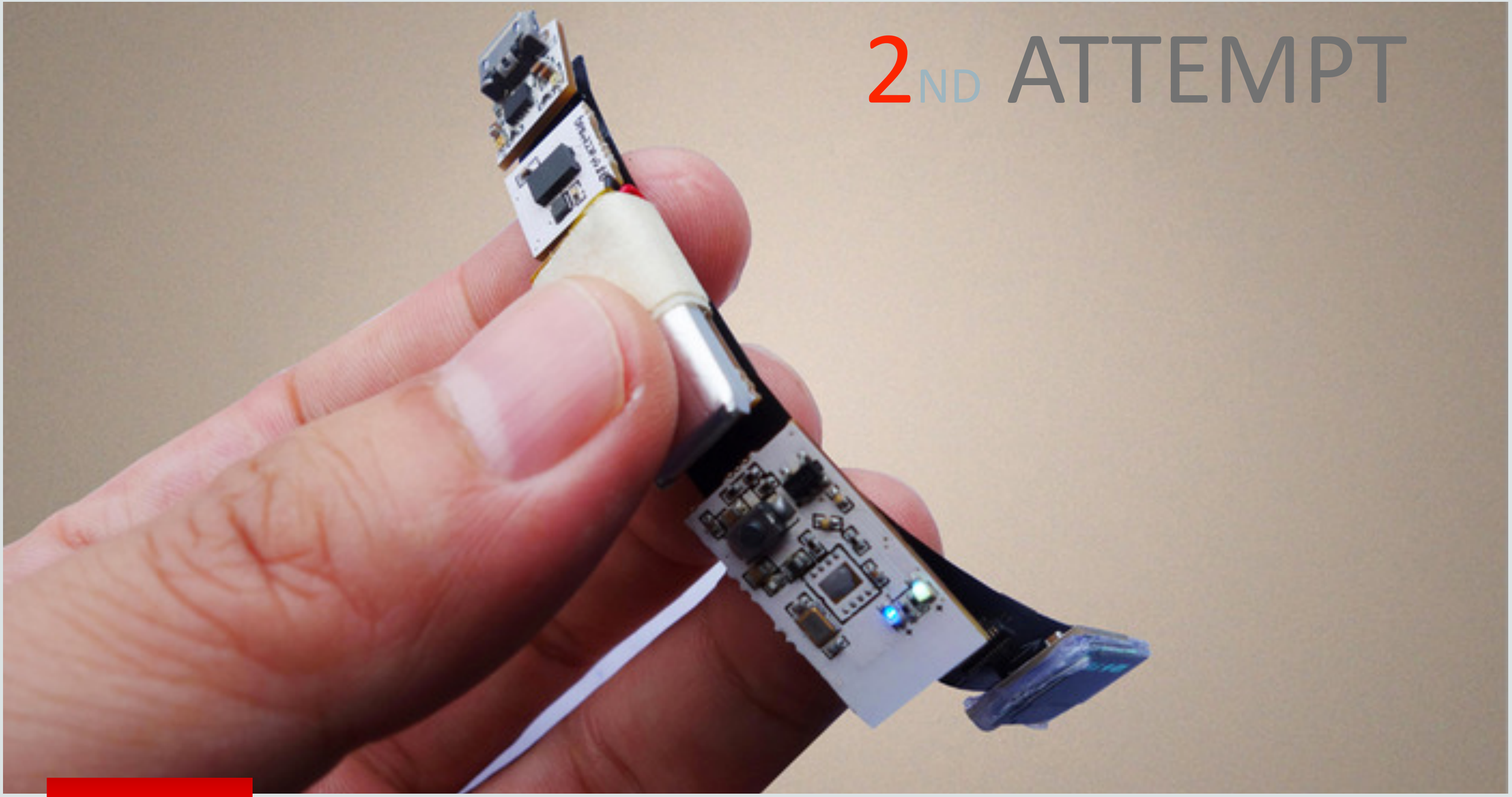
- Odroid-W board
- GPS sensor
- BLE adapter
- Accelerometer
- Java SE 8 embedded

1ST ATTEMPT

- To clunky
- Obtrusive
- Hard to handle
- No interactivity
- Battery life

2ND ATTEMPT

2ND ATTEMPT



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2ND ATTEMPT

- AtomWear
- Accelerometer
- BLE
- Tiny display
- C

2ND ATTEMPT

- No GPS
- Hard to handle
- Restricted interactivity
- Battery life

3RD ATTEMPT

3RD ATTEMPT

ORACLE

3RD ATTEMPT

- 3G/4G connection
- WiFi + BLE
- Long battery runtime
- Can count steps
- Water resistant

3RD ATTEMPT

- WiFi + BLE
- Long battery runtime
- Can count steps
- Interacts with phone
- Water resistant

3RD ATTEMPT

- Flic button(s)
- BLE
- Long battery runtime
- Can trigger alerts
- Multiple buttons possible

3RD ATTEMPT

- "Easy" to handle
- GPS
- Battery life (up to 2 days)
- Connectivity (4G, WiFi, BLE)
- Interactivity (voice, touch)

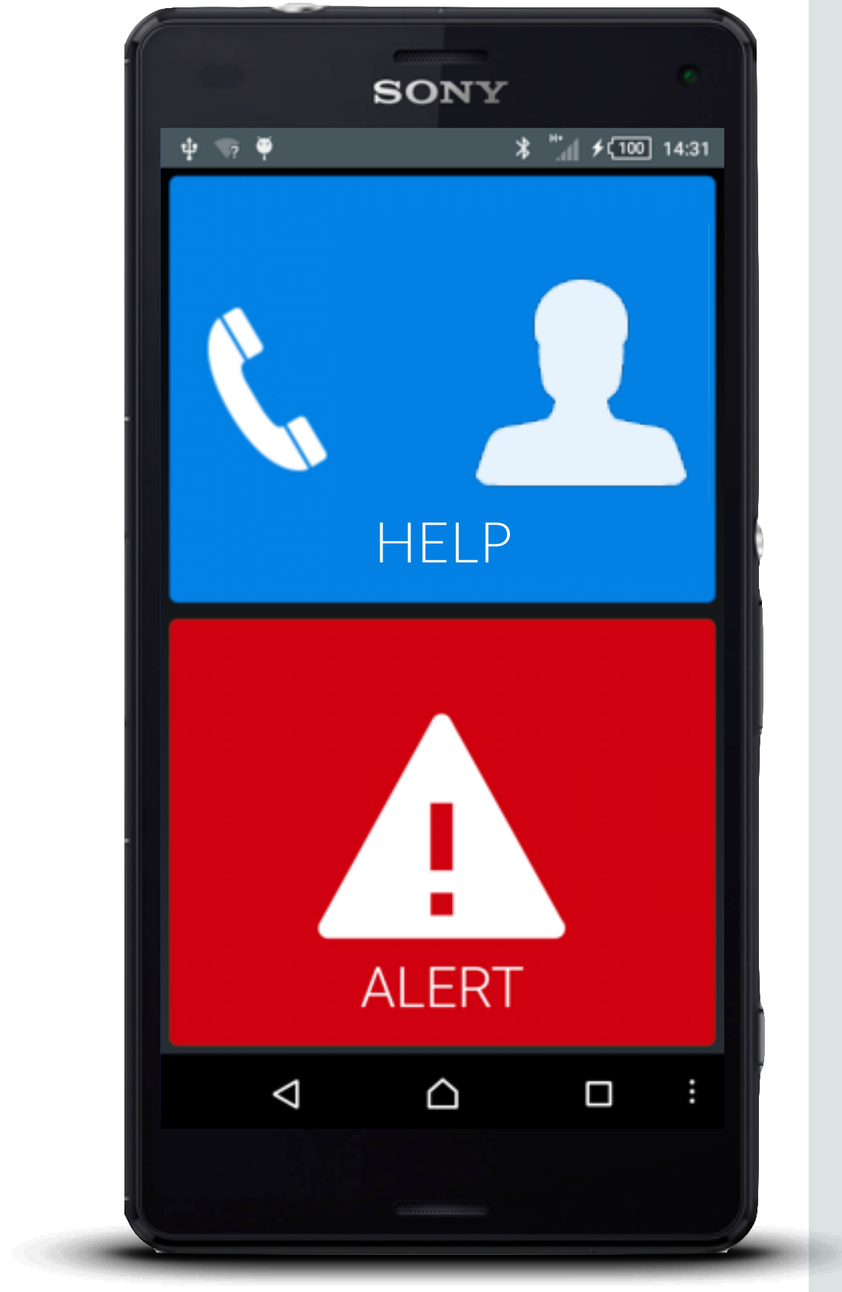
SOFTWARE REQUIREMENTS

SOFTWARE REQUIREMENTS

- Detect GPS location and Beacons
- Interact with Flic button
- Aggregate steps
- Call a contact person
- Publish data

MOBILE APPLICATION

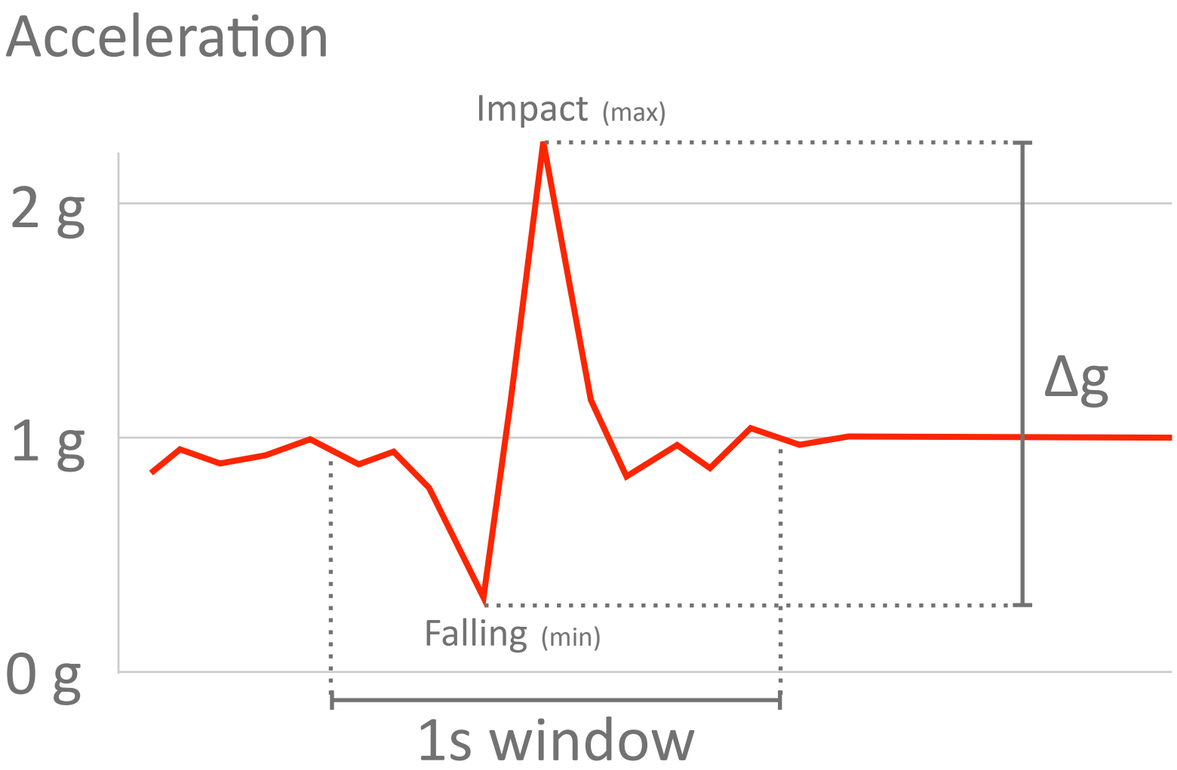
MOBILE APPLICATION SETUP



MOBILE APPLICATION

- Can call contact person
- Can send Alert message
- Collects steps
- Detect beacons/location
- Has fall detection

FALL DETECTION



- Fall detection
- Posture recognition
- Hit rate 85%

WEAR

APPLICATION

WEAR APPLICATION

- Call contact person
- Send Alert message
- Collects steps
- Interacts with phone via BLE and WiFi

WEAR APPLICATION

- Can be triggered by Watchface

FLIC BUTTON

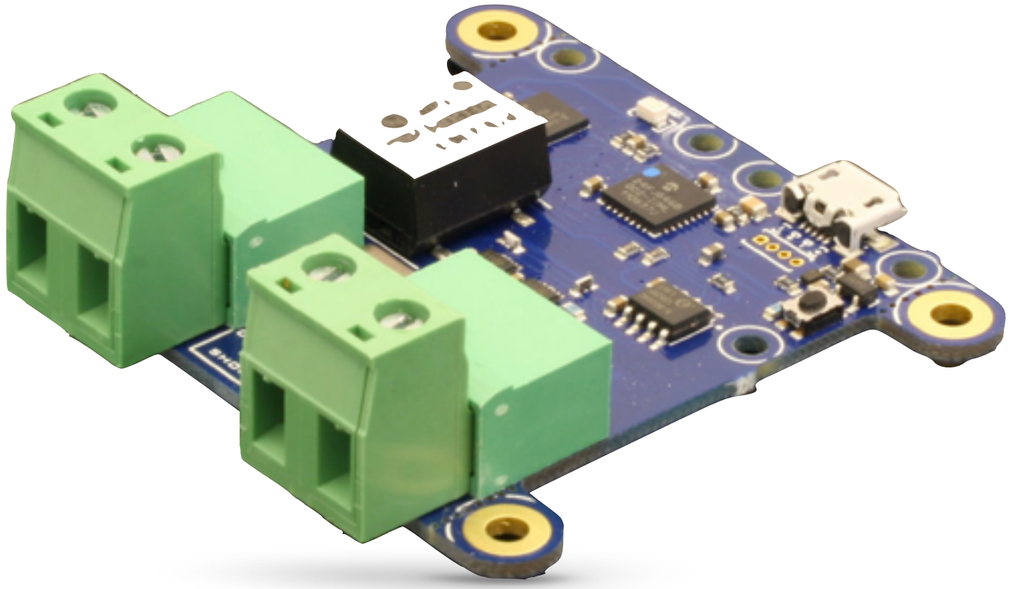
FLIC BUTTON

- Can trigger an Alert
- Can trigger a Call to contact person
- Interact with phone via BLE

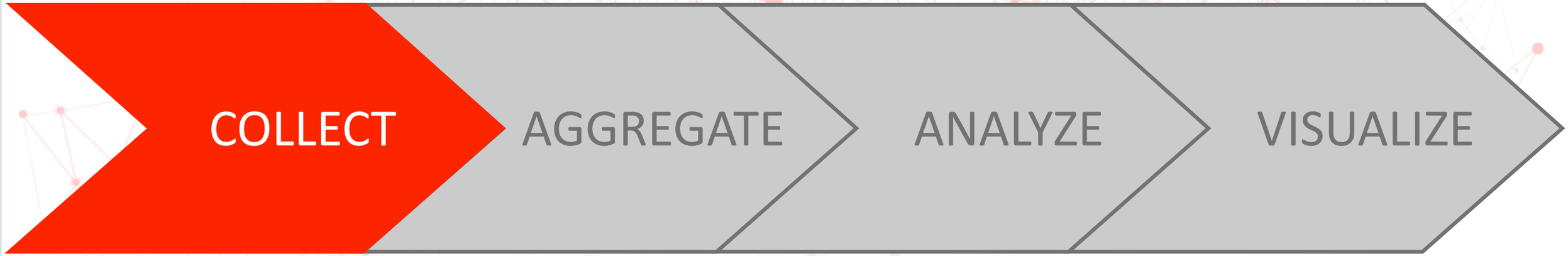
YOCTO WATT

YOCTOWATT

- Measures power consumption
- Interact with phone/ gateway via WiFi



DATA PROCESSING



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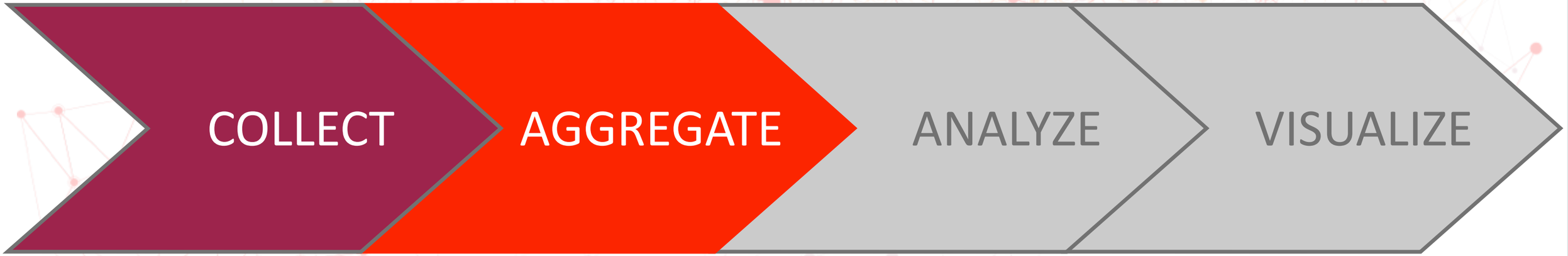


AGGREGATING

IOT GATEWAY

IOT GATEWAY

- ARM based Single Board Computer
- i.MX6 Quad 1GHz
- 4 GB RAM
- Java SE 8 emb.

IOT GATEWAY

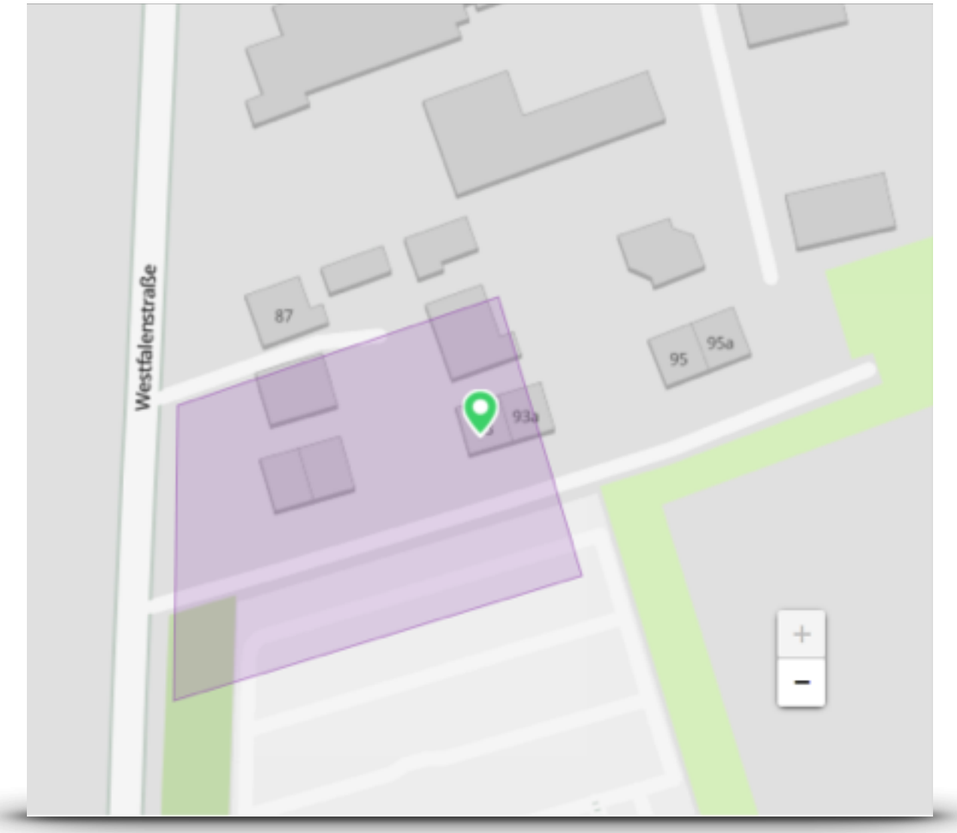
- Acts as GeoFence Server
- Aggregates data (direct, mqtt)
- Filters data
- Forwards data

GEO FENCING

ORACLE

GEO FENCING

- Receives location
- Checks against fences
- Reacts on entering or leaving a fence



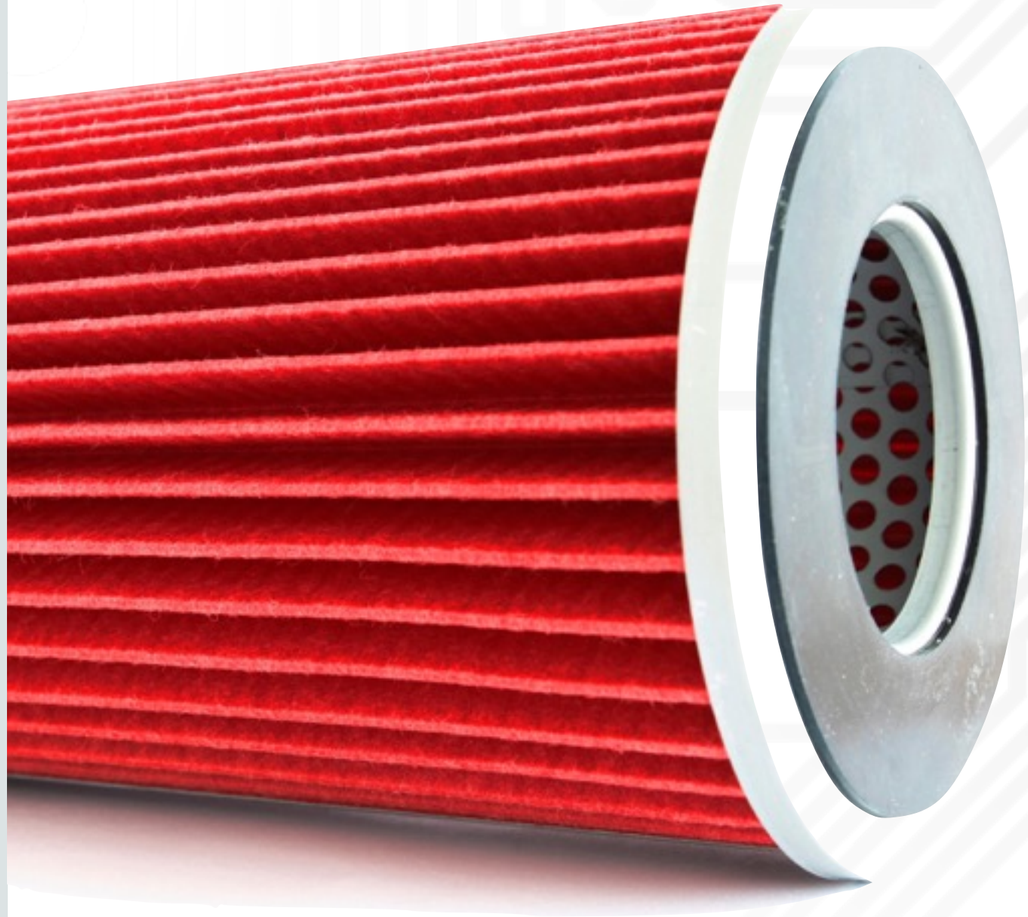
AGGREGATING

DATA

ORACLE

AGGREGATING DATA

- From directly connected sensors
  (TV set)
- From mobile phone
  (via MQTT)
- From GeoFence server
  (directly or via MQTT)



FILTERING DATA

FILTERING DATA

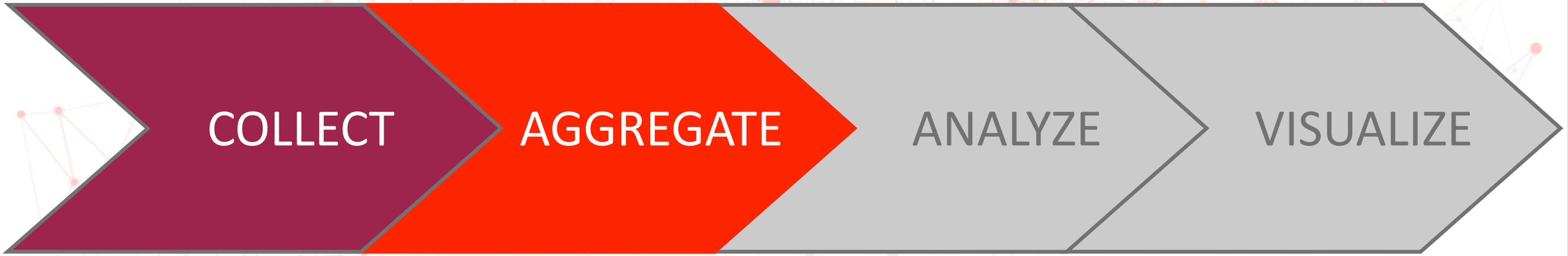
- Filter faulty sensor data
  (wrong TV power consumption readings)
- Filter wrong location data
  (jumping location due to bad gps signal)
- Filter geo fence data
  (toggle between inside/outside fence due to bad gps)

DATA FORWARDING

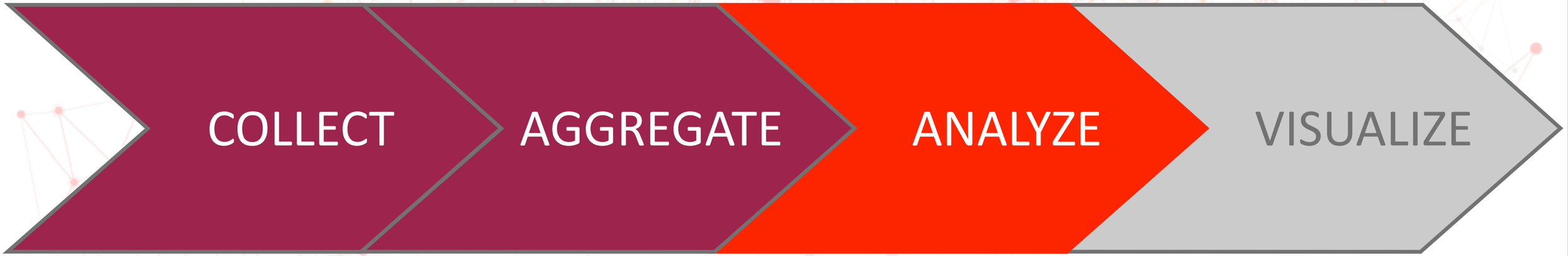
DATA FORWARDING

- Forwards filtered person data via REST
  (used in visualization app)
- Forwards filtered data to a database
  (aggregated steps are stored once a day)

DATA PROCESSING



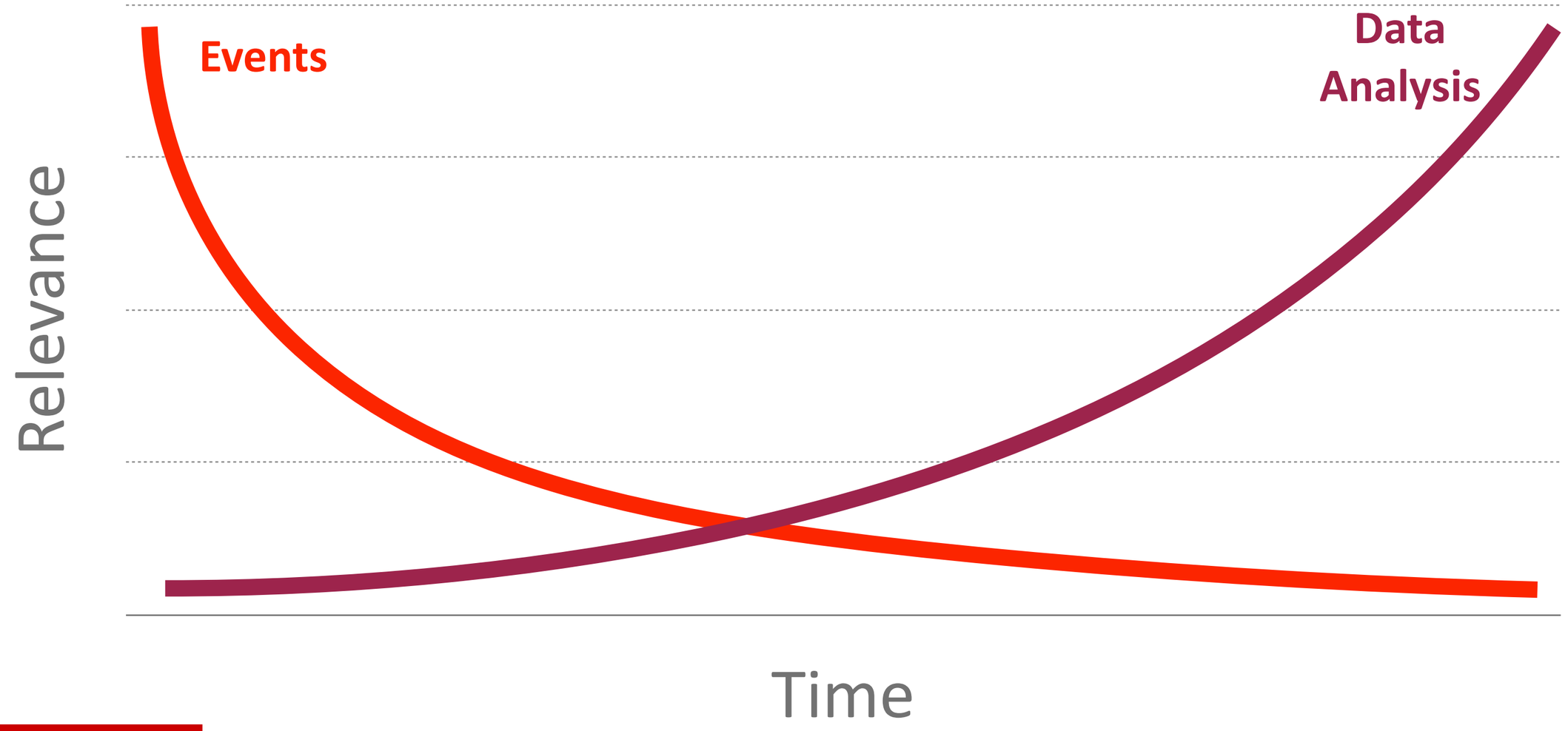
DATA PROCESSING



ORACLE

ANALYZING

ANALYZING



ANALYZING

- Simulation Dataset
- 5,000 people x 3 months history x 5 minute event interval
- 129 Million Events

(spark.apache.org)

ORACLE

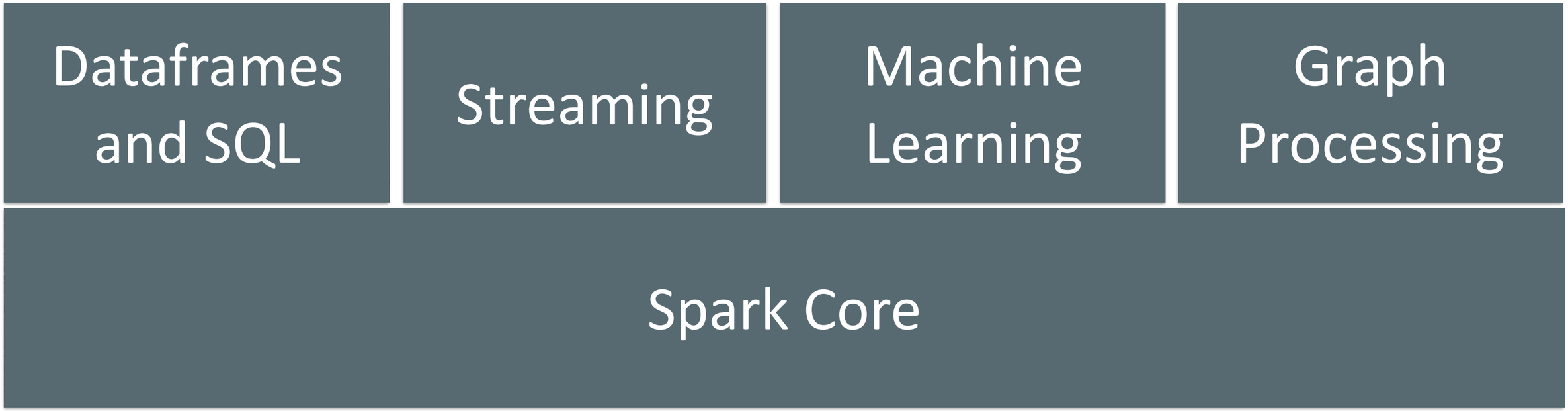
- General purpose cluster computing system
- Started in AMPLab at University of California, Berkeley in 2008
- Open sourced in 2009

- Engine written in Scala with API support for Scala, Java, Python and R (as of version 1.5)
- Core engine with modules

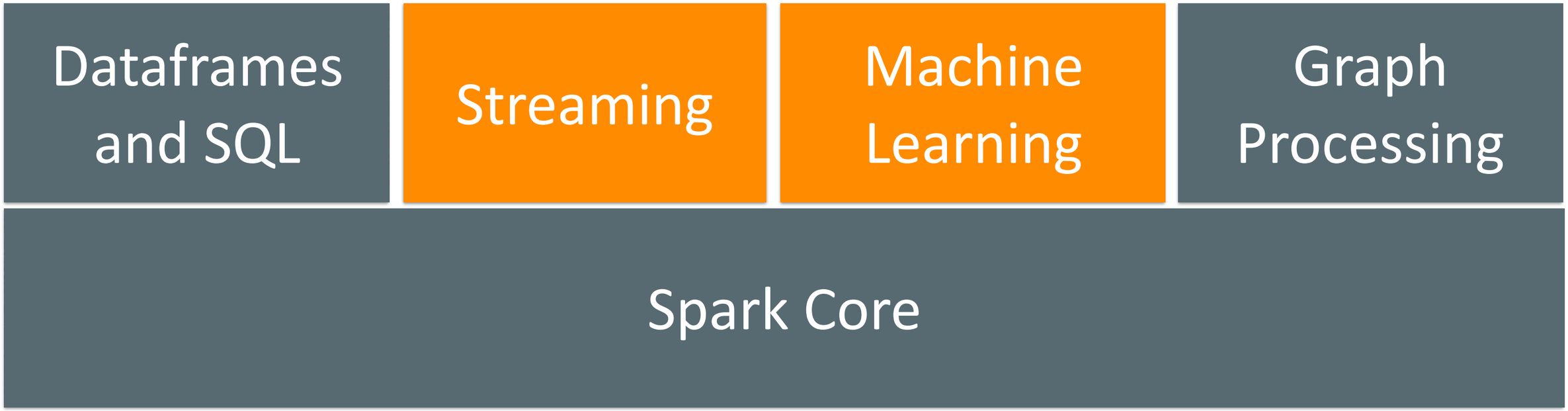
- Supports >80 data analysis algorithms
- map-reduce, groupBy, fold, join, count, union, sum,…
- Data from HDFS, Cassandra, SQL, Streams and many others

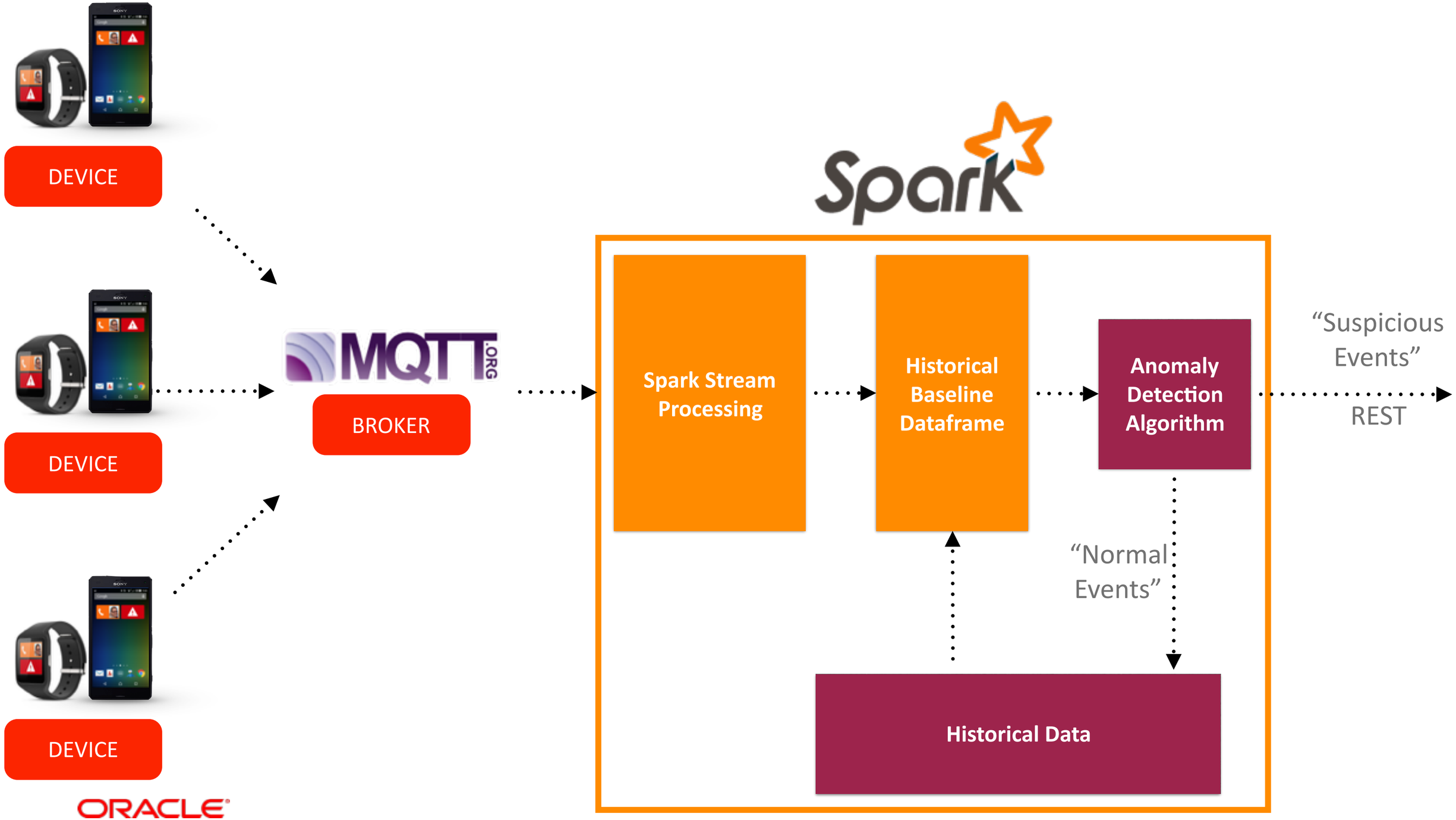
ORACLE

Architecture



Architecture

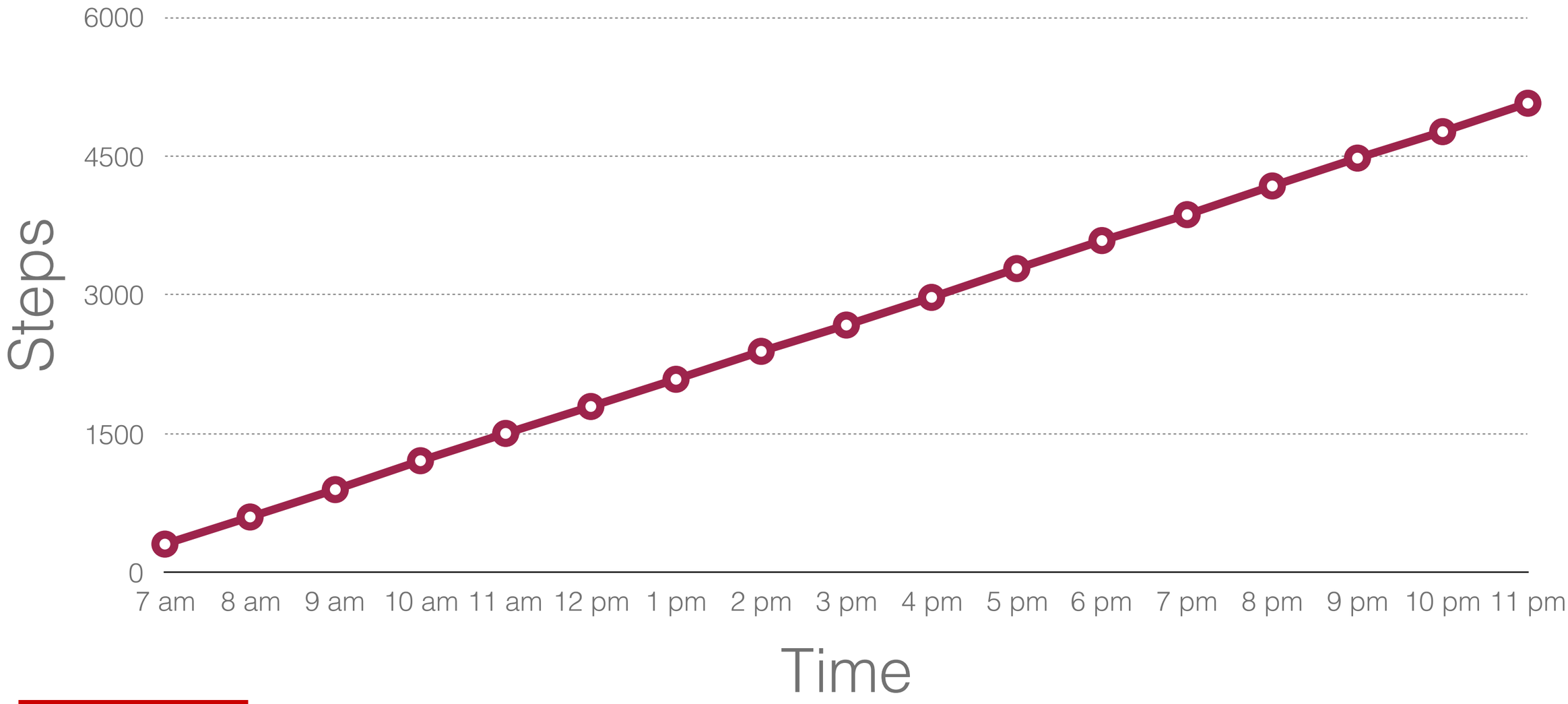



DEVICE
DEVICE
DEVICE
MQTT.ORG
BROKER
Spark
Spark Stream Processing
Historical Baseline Dataframe
Anomaly Detection Algorithm
"Suspicious Events"
REST
"Normal Events"
Historical Data
ORACLE

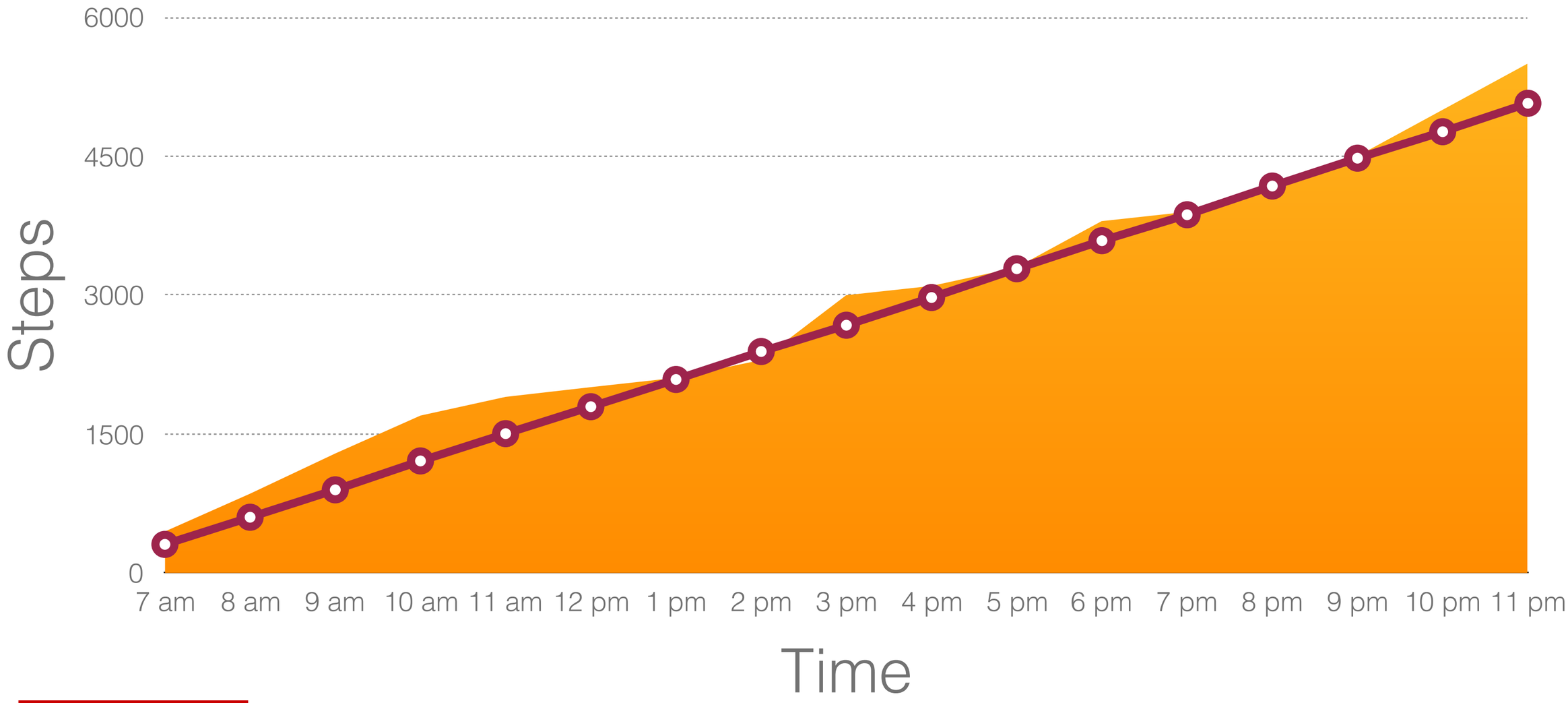
RULES

- Usually person walks 4500 steps a day
- Usually person is going to the supermarket every Tuesday
- Usually person uses TV for 5h a day
- …

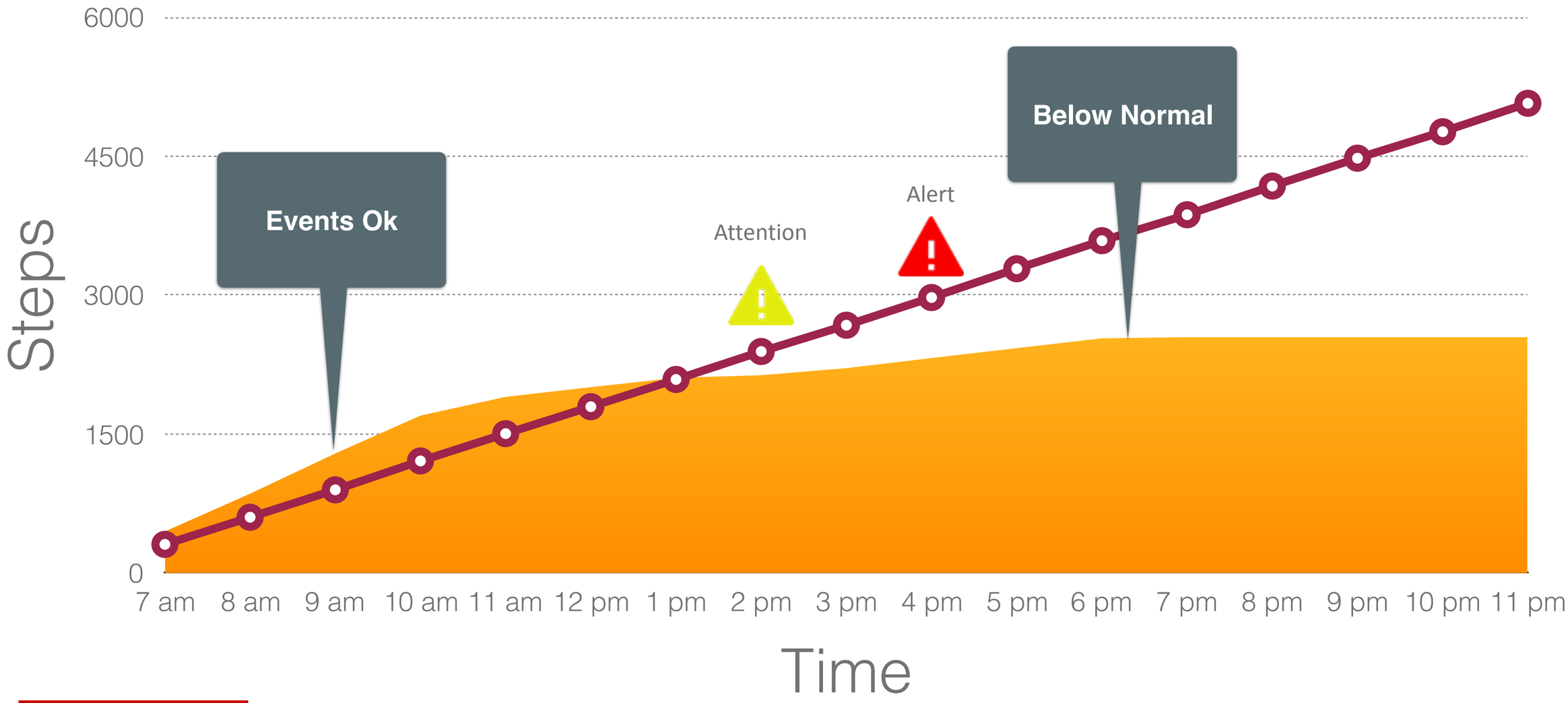
Individual Base Line



Daily Steps Within Typical Range



Daily Steps With Potential Anomaly



DATA PROCESSING

ORACLE

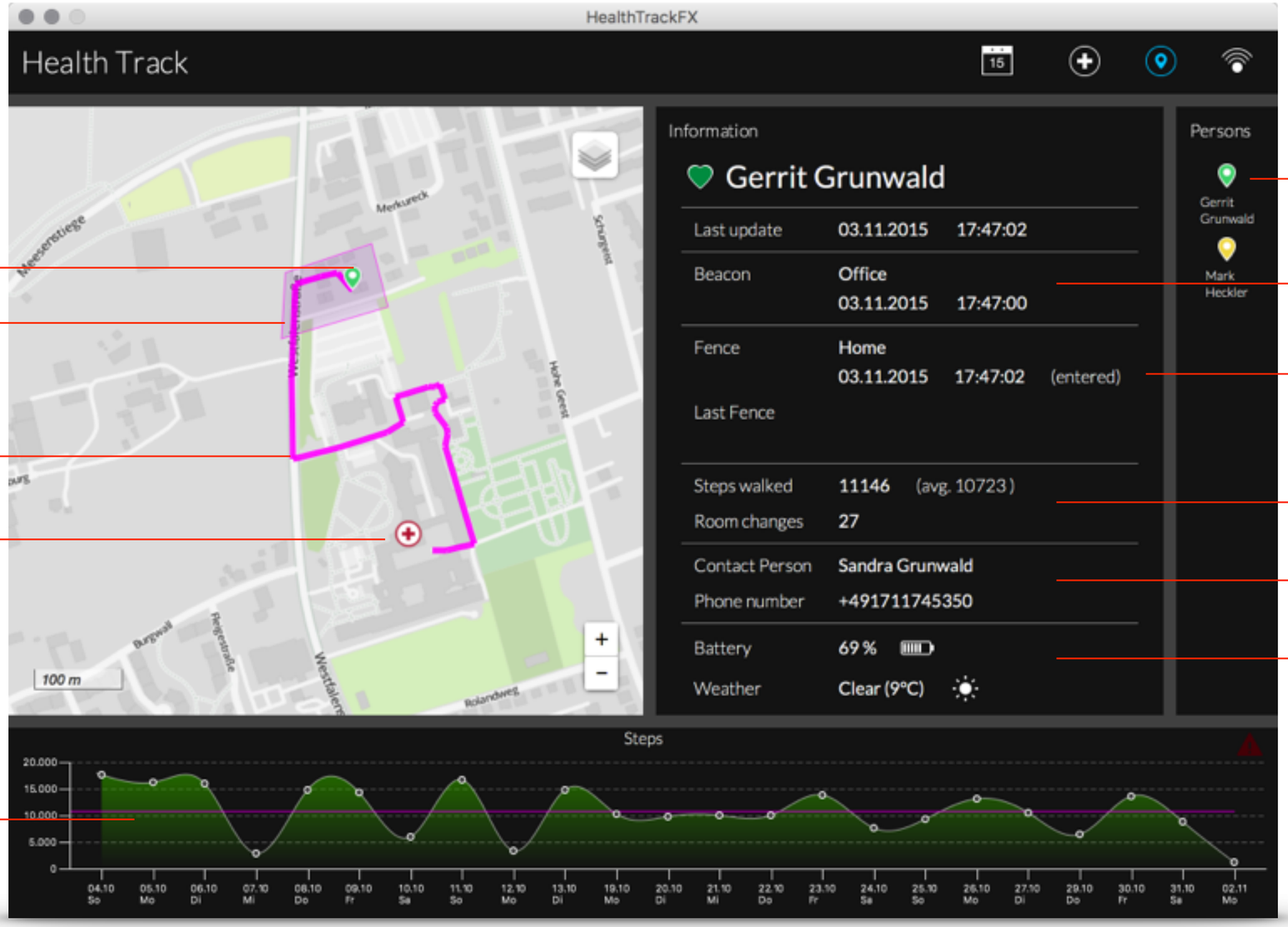
VISUALIZING

DESKTOP CLIENT

DESKTOP CLIENT

- Cross platform Java desktop client
- Show last known location
- Show information of person
- Show information of contact person
- Data via SSE from Application Server

DESKTOP CLIENT



Location
GeoFence

Routing

Nearest hospital

Steps walked

Persons

Current Room

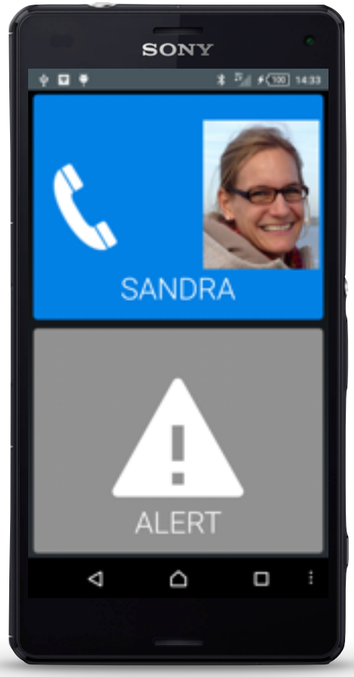
Current Fence

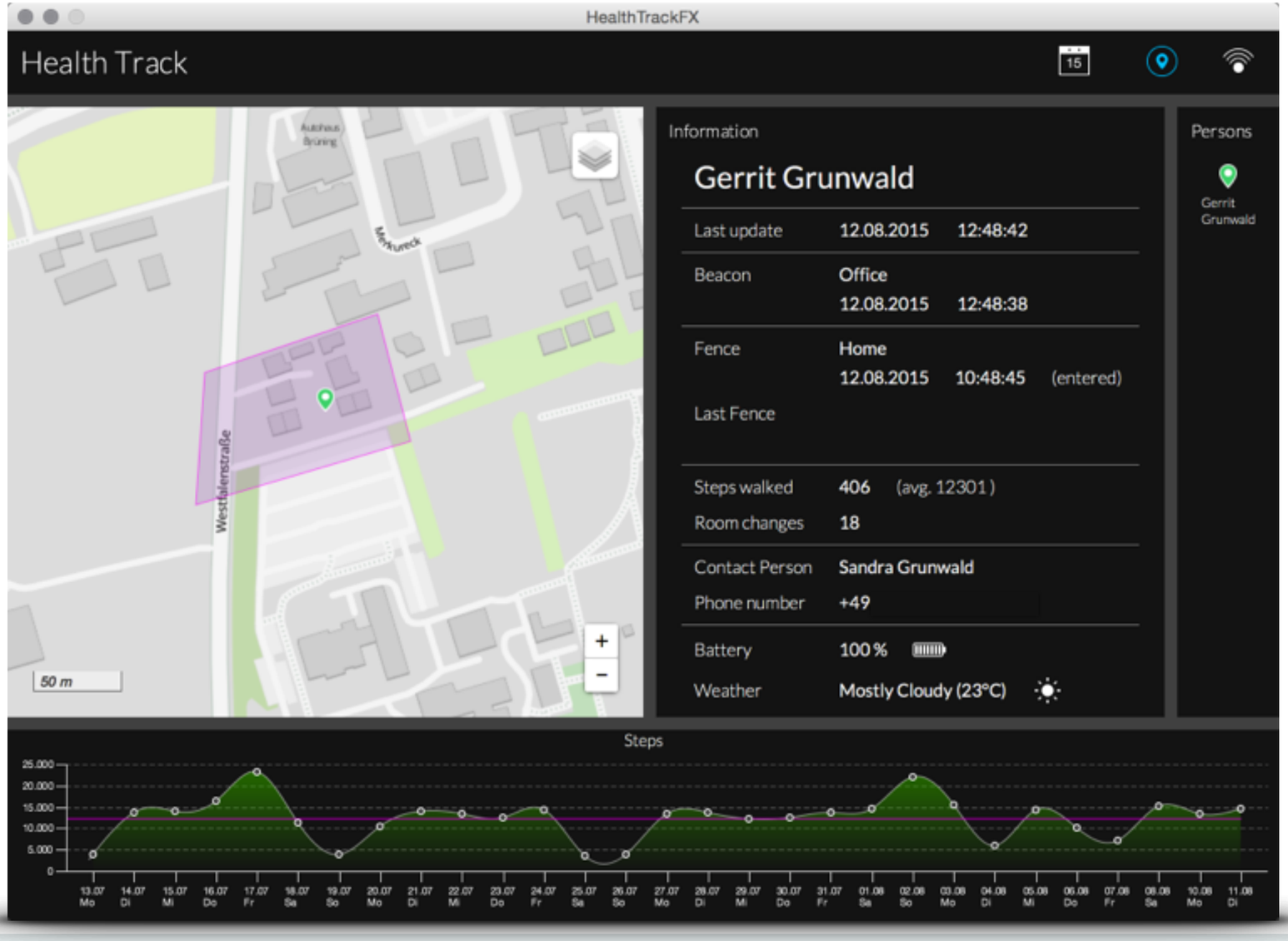
Steps today

Contact Person

Battery, Weather, Day/Night

DESKTOP CLIENT





SETUP

GATEWAY APPROACH

BLE

COLLECT

MQTT

MQTT.ORG

BROKER

MQTT

Spark

ANALYZE

VISUALIZE

MQTT

REST

REST

SSE

WiFi

AGGREGATE

REST

SERVER

REST

3rd PARTY

ORACLE

SIMPLIFY

GATEWAY APPROACH

BLE

COLLECT

MQTT

MQTT.ORG

BROKER

MQTT

Spark

ANALYZE

VISUALIZE

MQTT

REST

REST

SSE

WiFi

AGGREGATE

REST

SERVER

REST

3rd PARTY

ORACLE

GATEWAY APPROACH

BLE

COLLECT

MQTT

MQTT.ORG

BROKER

MQTT

VISUALIZE

SSE

WiFi

AGGREGATE

REST

IoT
Cloud Service

ANALYZE

REST

3rd PARTY

SIMPLIFY MORE

GATEWAY APPROACH

BLE

COLLECT

MQTT

MQTT.ORG

BROKER

MQTT

VISUALIZE

SSE

WiFi

AGGREGATE

REST

IoT
Cloud Service

ANALYZE

REST

3rd PARTY

DIRECT APPROACH

BLE

COLLECT

REST

IoT
Cloud Service

ANALYZE

AGGREGATE

SSE

VISUALIZE

REST

WiFi

3rd PARTY

ORACLE

CURRENT SETUP

DIRECT APPROACH

BLE

COLLECT

MQTT

WiFi

Spark

ANALYZE

REST

SERVER

SSE

VISUALIZE

REST

3rd PARTY

CONCLUSION

IOT CAN BE HELPFUL BUT…

- Devices have to be more unobtrusive
- Technology must be more easy
- Problematic to convince people
- Data Privacy and Security are critical
- Rural internet access is crucial


ORACLE®