Towards computers everywhere
(and what this means for medicine and healthcare)

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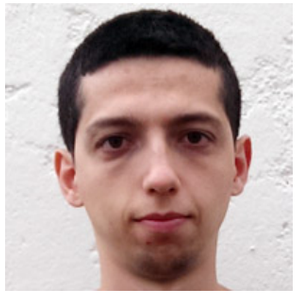
School of Computing and Information Systems
University of Melbourne

3 October 2017
Talk given at the Northern Health Research Week
Northern Health, Melbourne



Jorge Goncalves

Eduardo Velloso

Thomas Christy

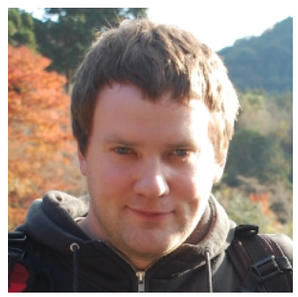
Niels van Berkel

Chu Luo

Zhanna Sarsenbayeva

Yitong Chen

Denzil Ferreira



Simo Hosio

Simon Klakegg

Aku Visuri

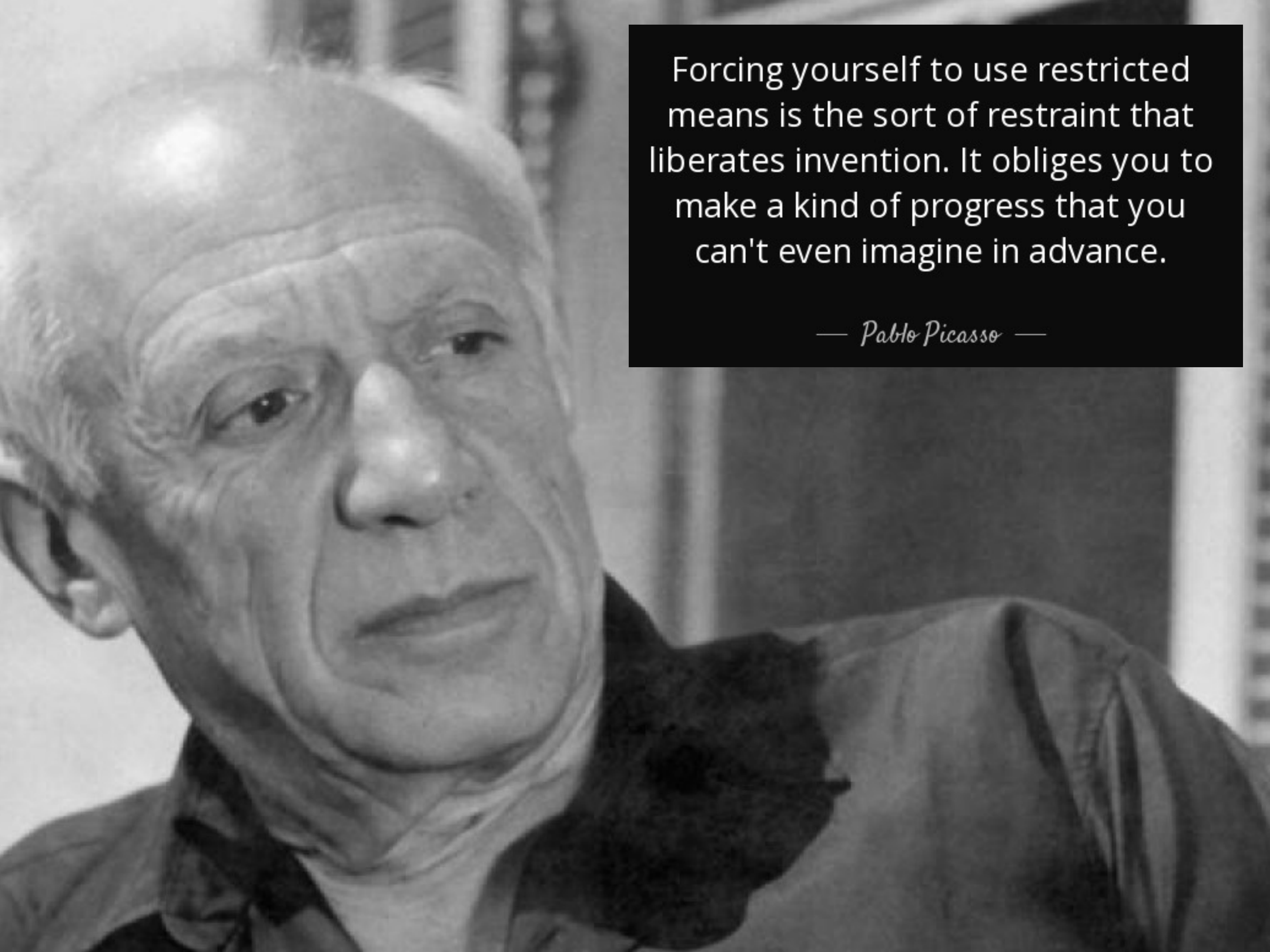
What your phone knows about you

~

Computer scientists are not (just) programmers

~

Let’s collaborate!


Forcing yourself to use restricted means is the sort of restraint that liberates invention. It obliges you to make a kind of progress that you can't even imagine in advance.
— Pablo Picasso —

Brief history of computing

1960’s

1980’s

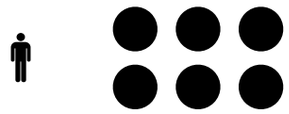
2000’s

3 “Waves” of computing

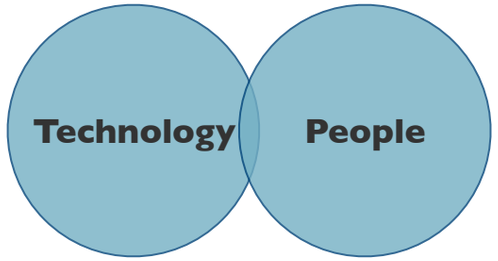
Capabilities

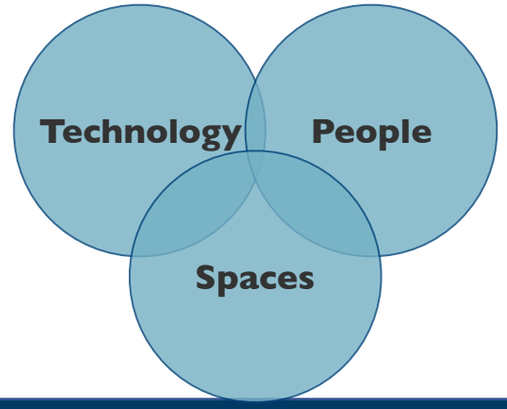
Size

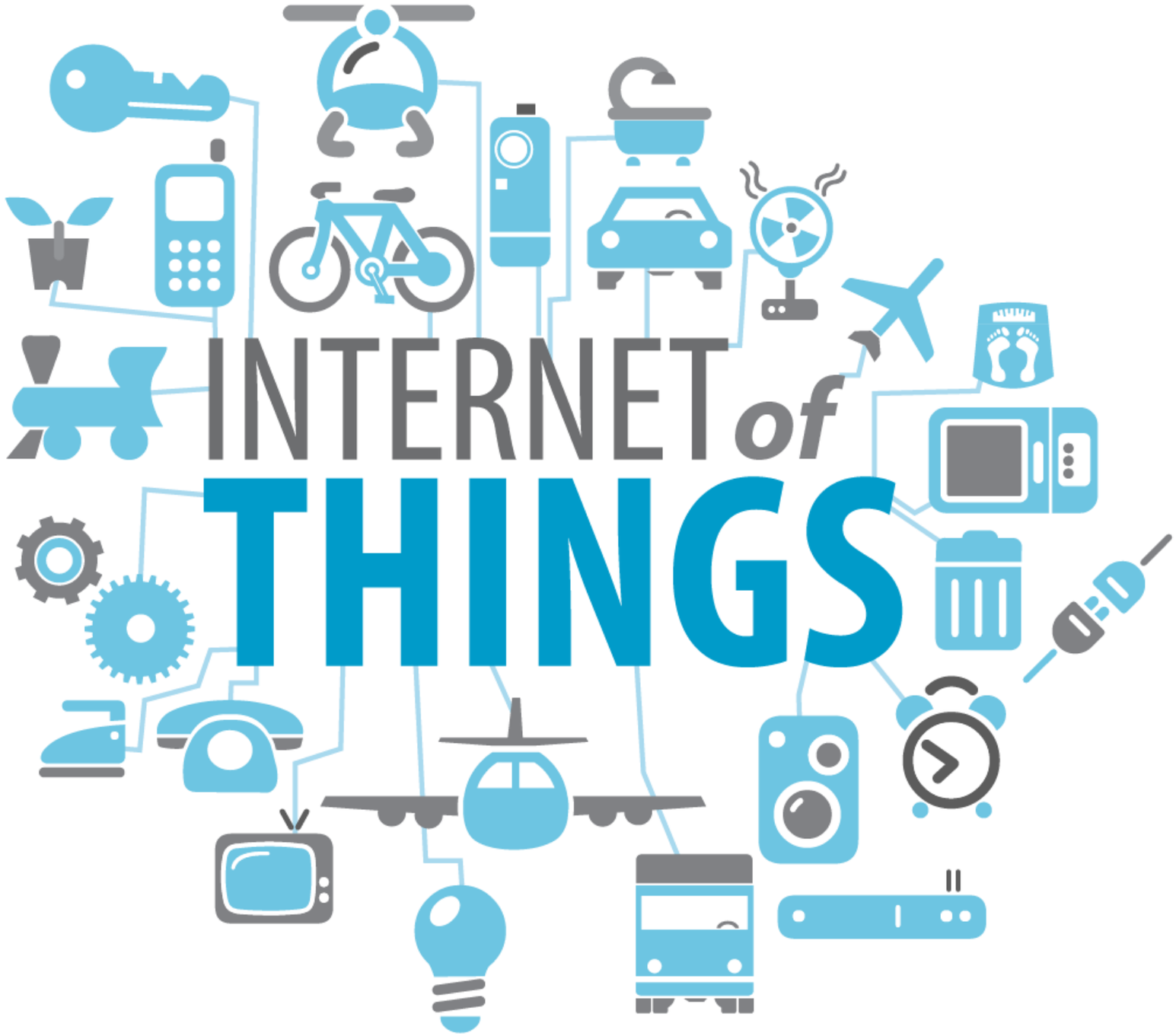
Usage



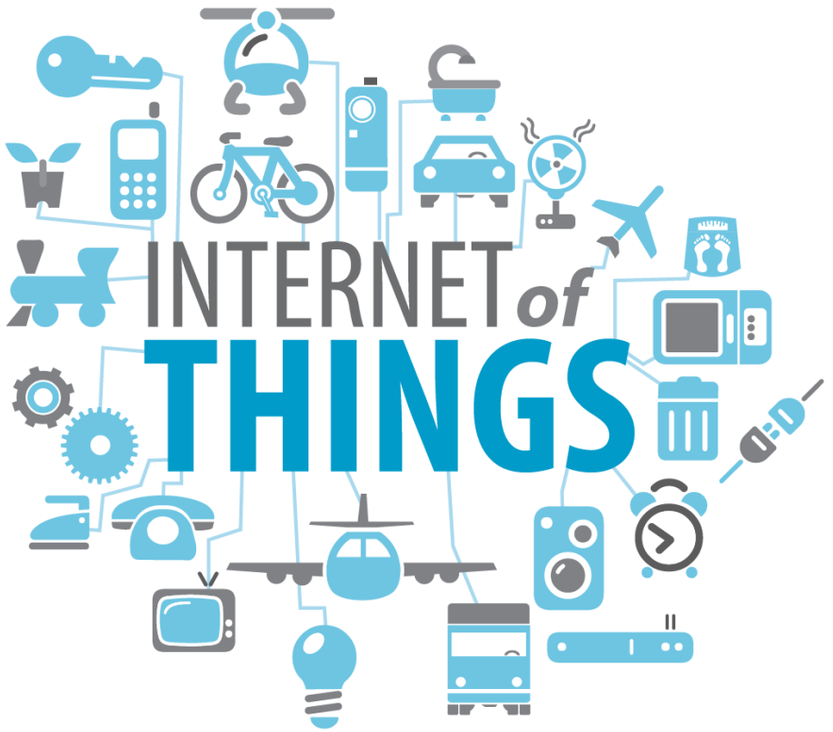
Research






INTERNET of
THINGS

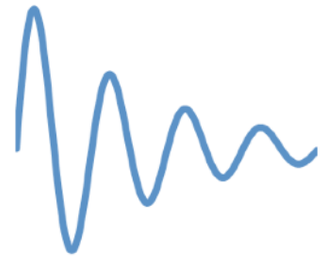
Understand people -> build better technology



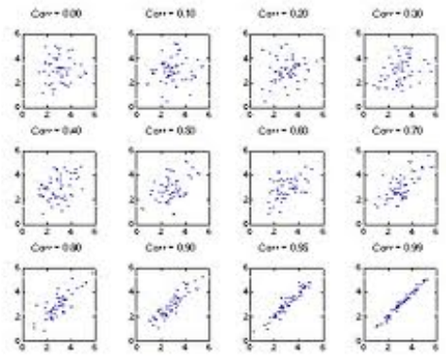
Study technology -> better understand people

Modus operandi

Smartphone/Facebook data

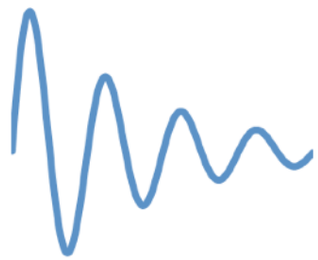


Calculate metrics



Establish correlations
Describe behaviour

Behaviour, attitudes, questionnaires, etc.



Calculate metrics

Sources

Social Media

Smartphone use

Smart city

Interaction

Insights

Happiness

Personality

Habits

Exposure

Methods

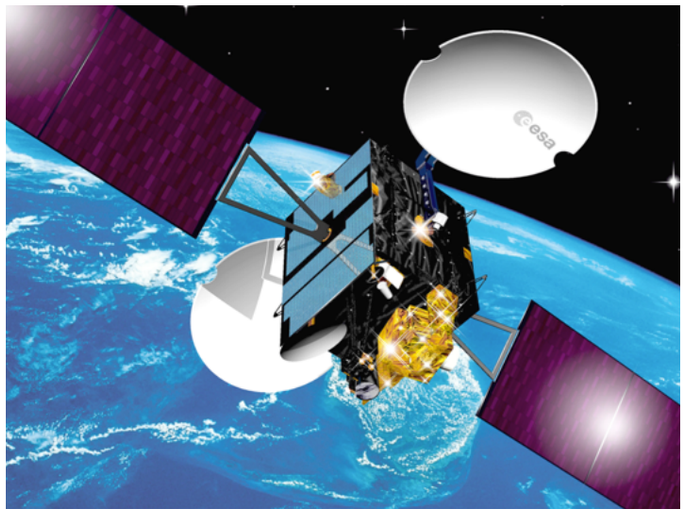
Smartphone instrumentation

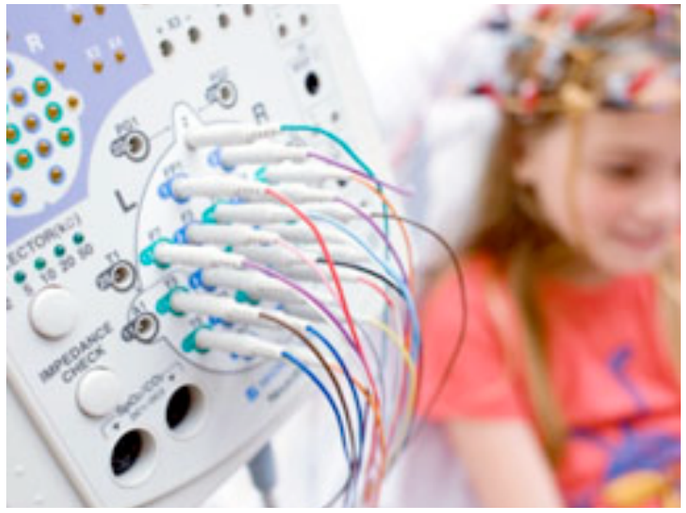
Crowdsourcing

In-the-wild methods

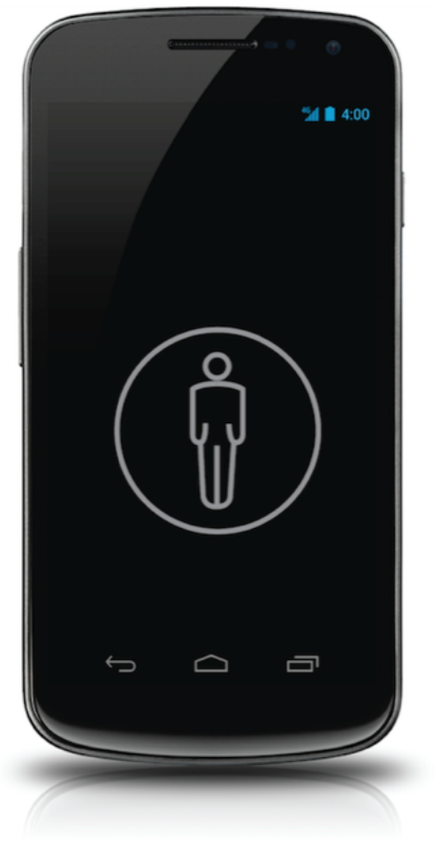
Smartphones for science

Scientific instruments

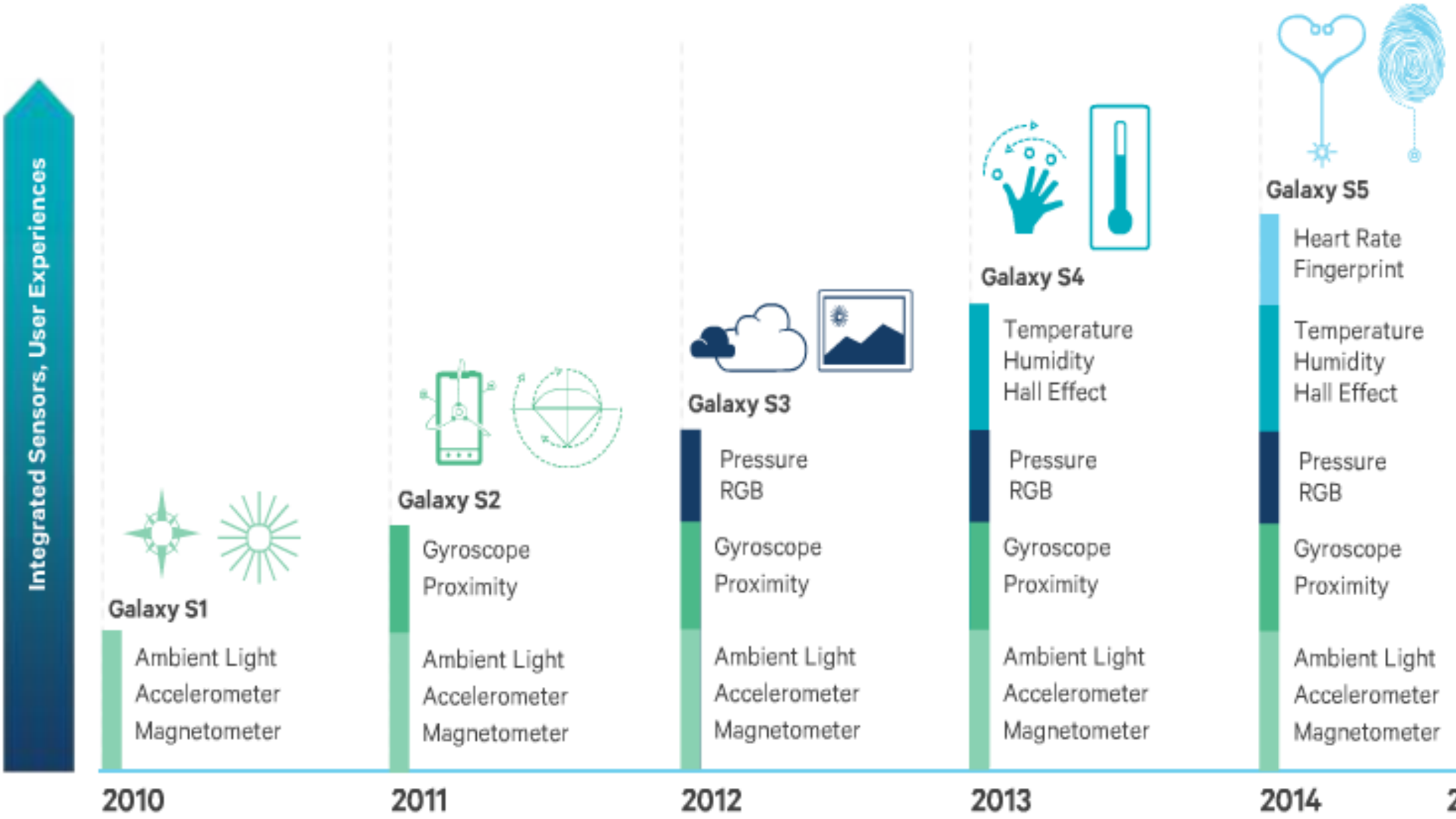




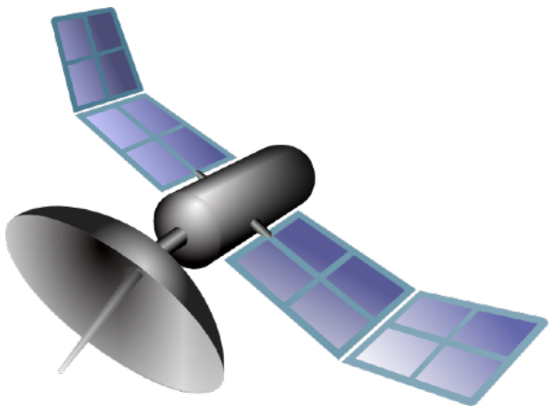
Non-invasive sensing



Sensor growth in smartphones



Over the next 10 years



1 200

590 000 000

3 500 000 000

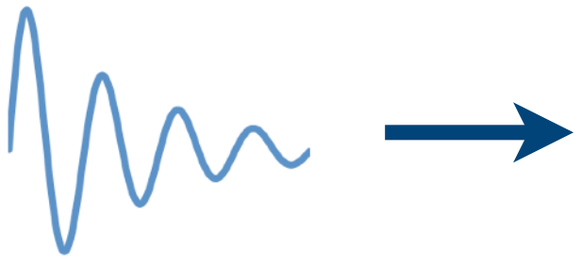
18 000 000 000

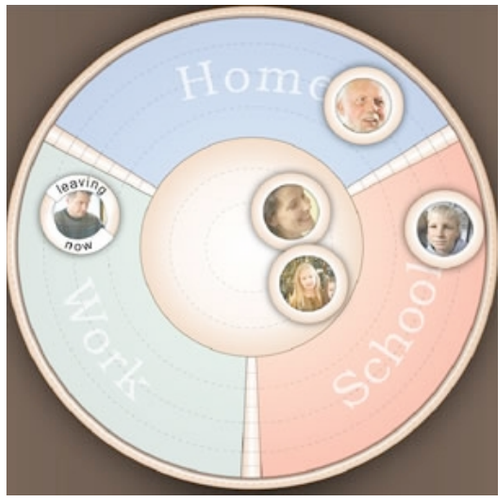
40 x

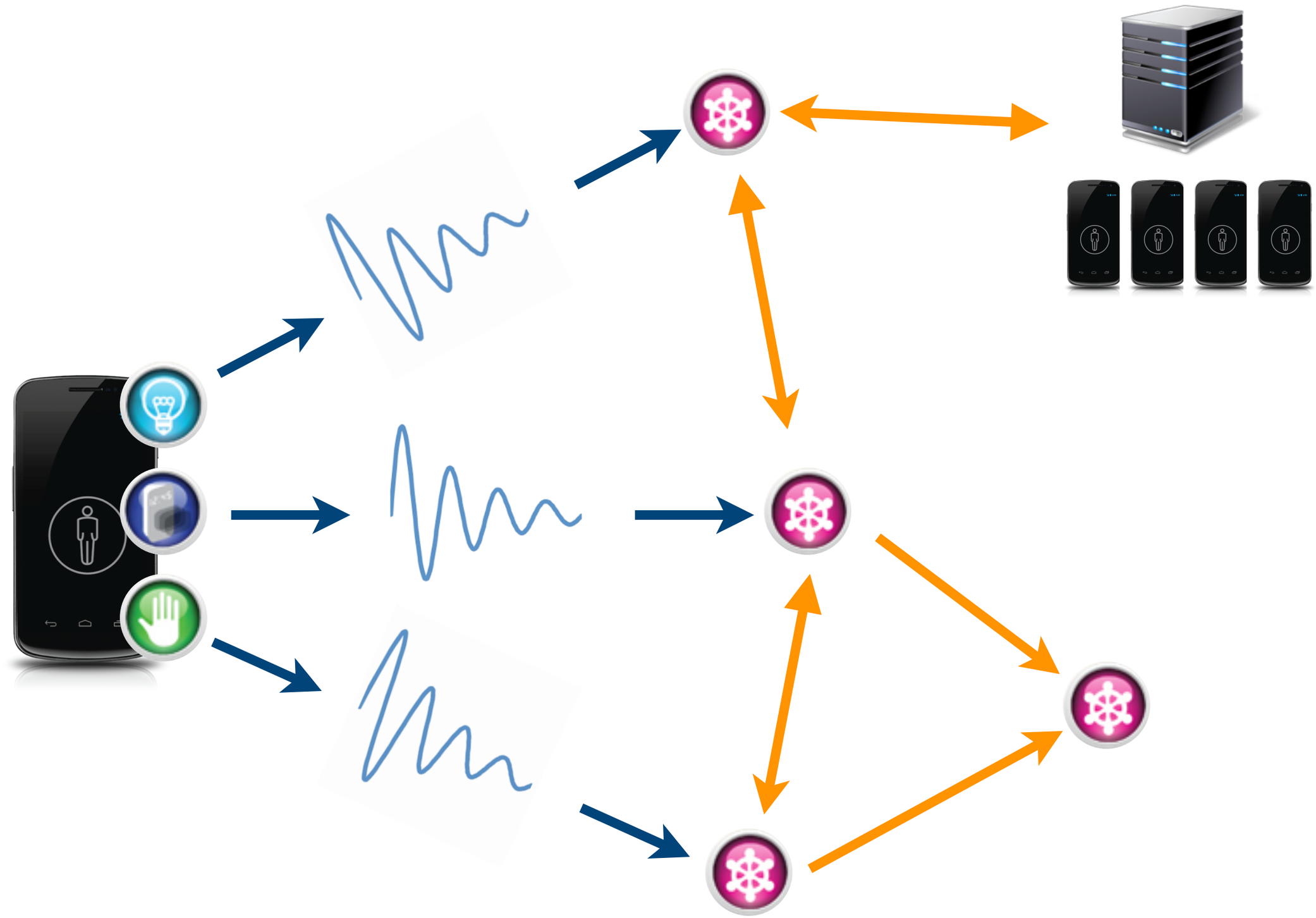
What to analyse?

How to analyse?

Start from scratch





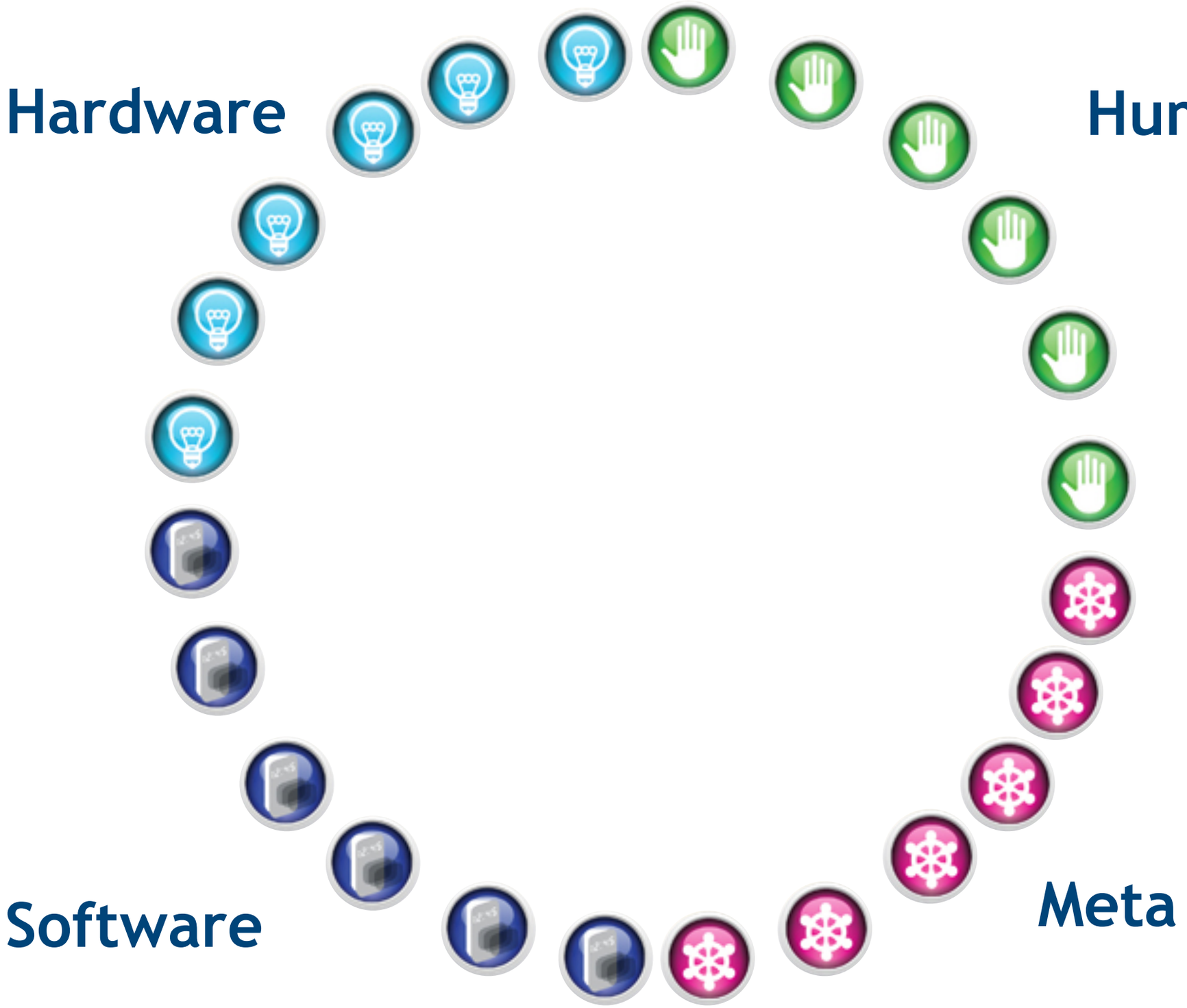


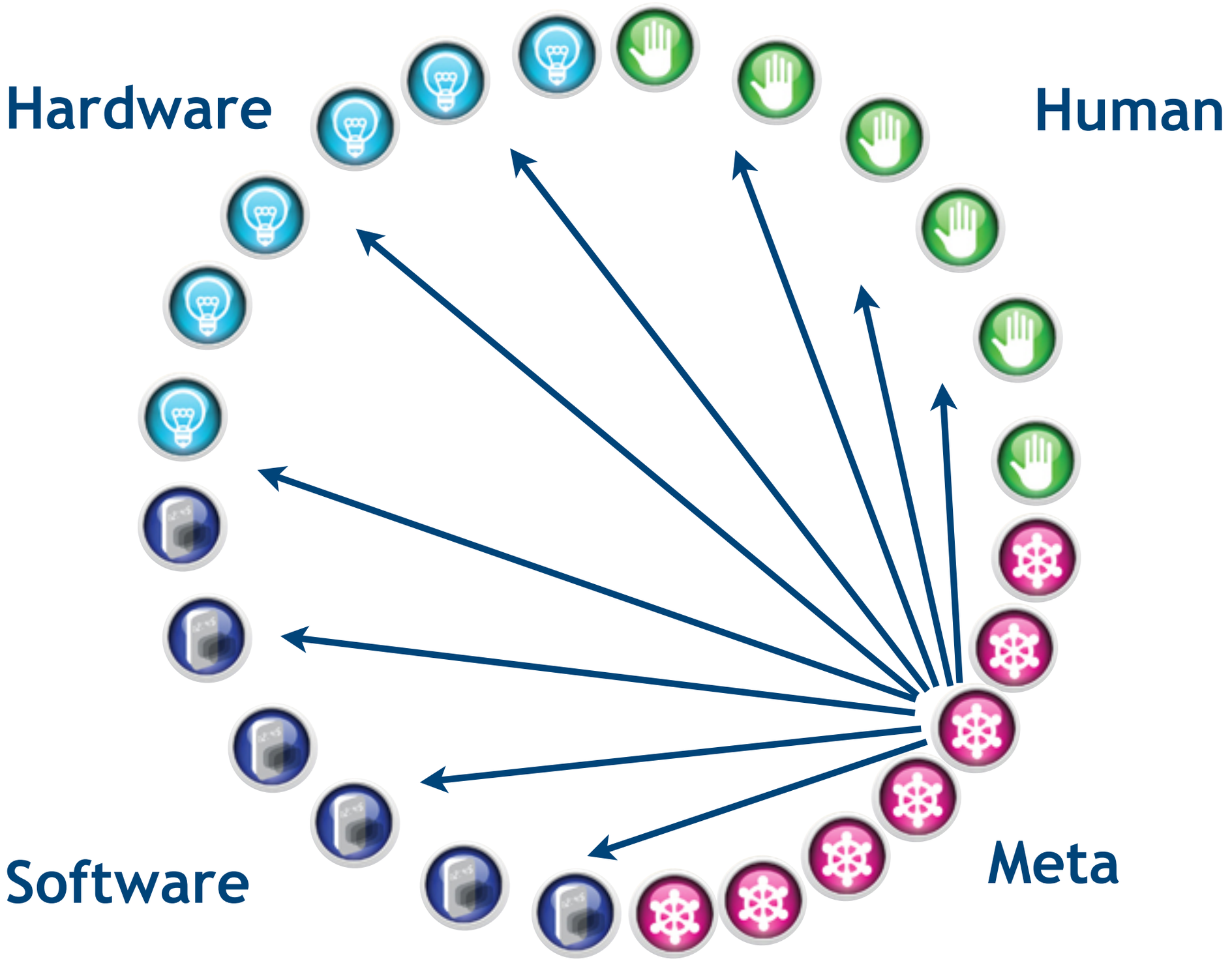
Hardware

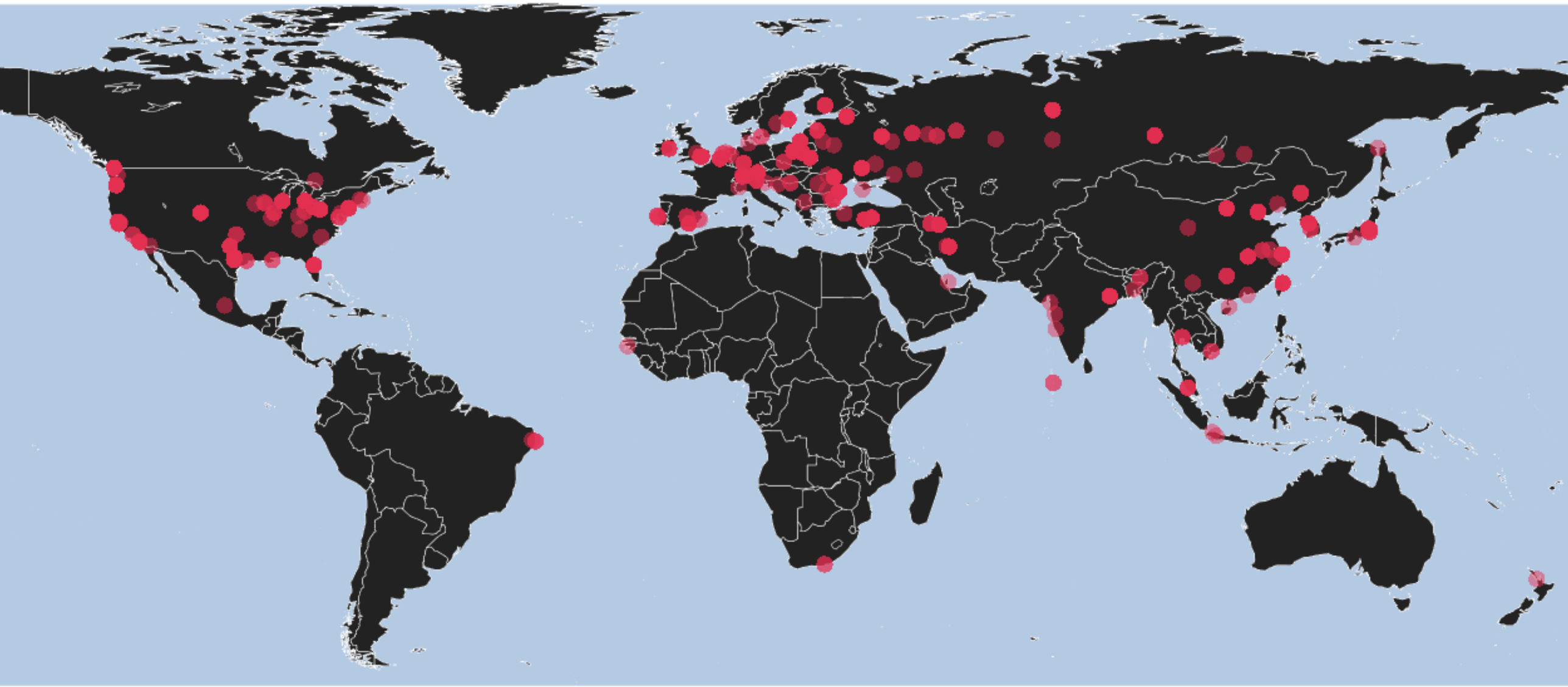
Software

Human

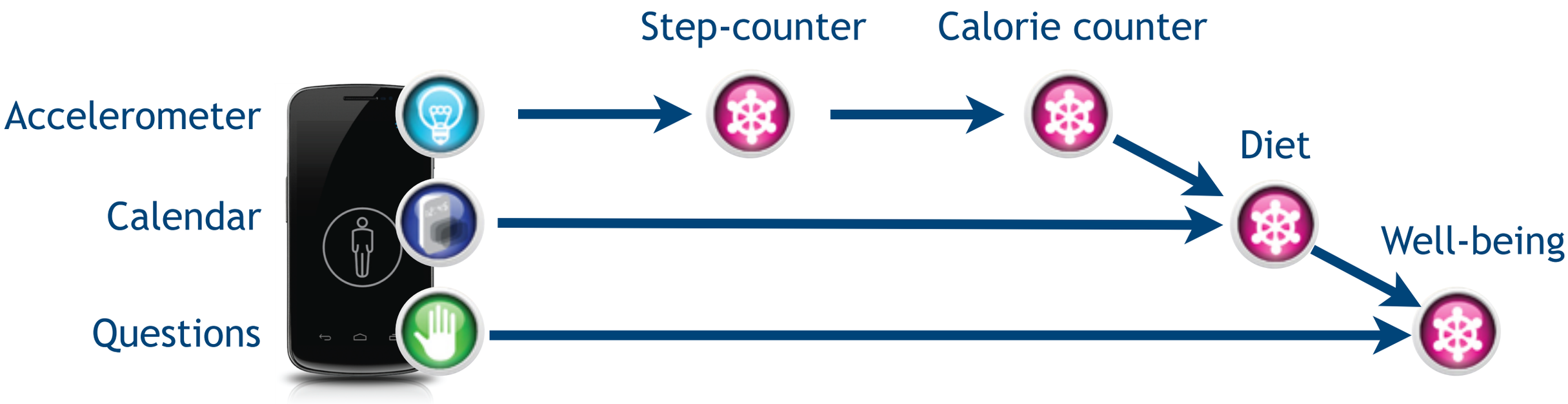
Meta


Hardware
Human
Software
Meta


Hardware
Human
Software
Meta



“LEGO” - context

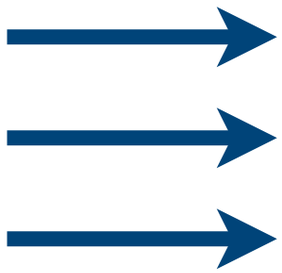


Scientist

Define study

Deploy to participants

Visualise



Store data
(MySQL)

Scientific instrument

Experience Sampling Method

Passive sensor collection

Behavioural studies
(Personality prediction)

Medical studies
(Parkinson's / Cancer / Pain)

Environmental exposure studies
(Urban mobility)

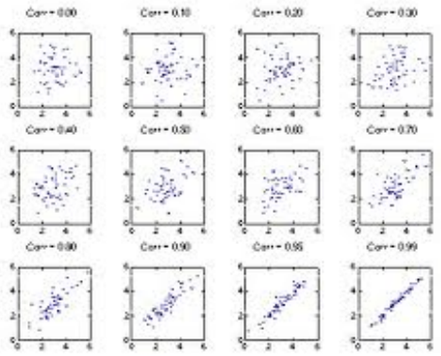
Transport engineering
(Crowd simulation, queue modelling)

Economics
(Power consumption modelling)

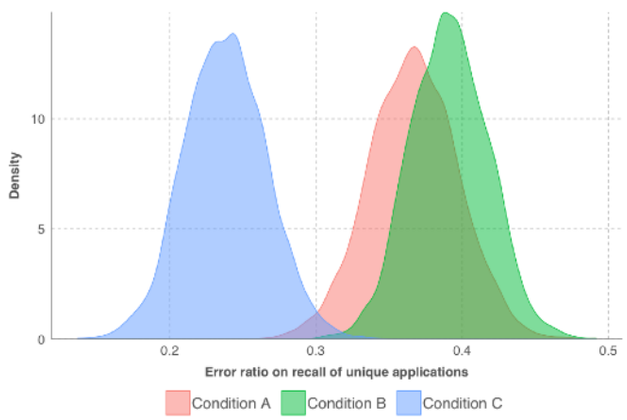
Measurement

Phenomena

Sample data



Analysis/Statistics

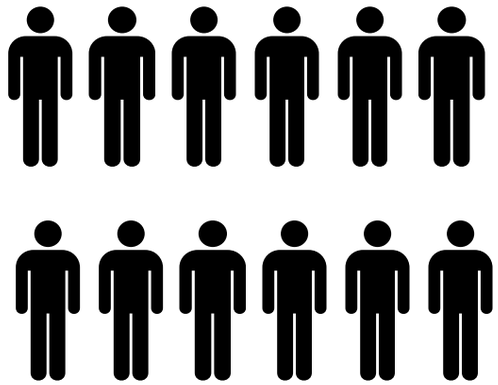


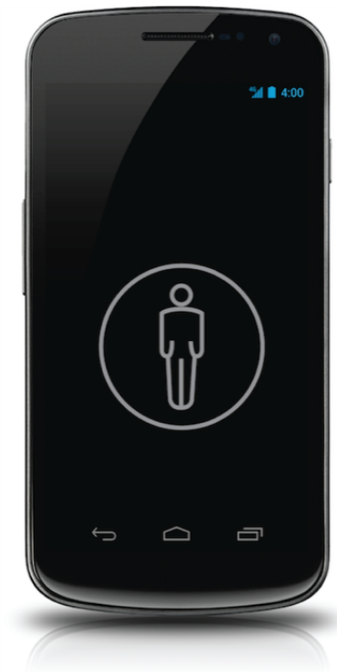
Measurement instrument

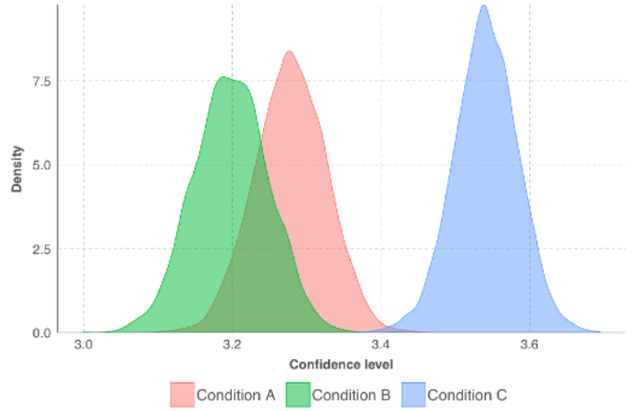
- Bias
- Reliability
- Transparency
- Repeatability

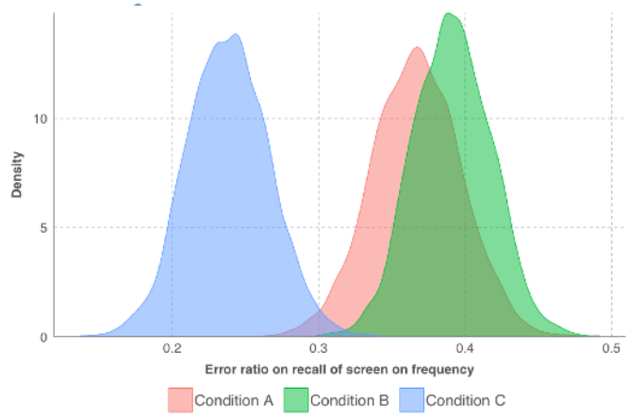
- Privacy
- Battery life
- Convenience

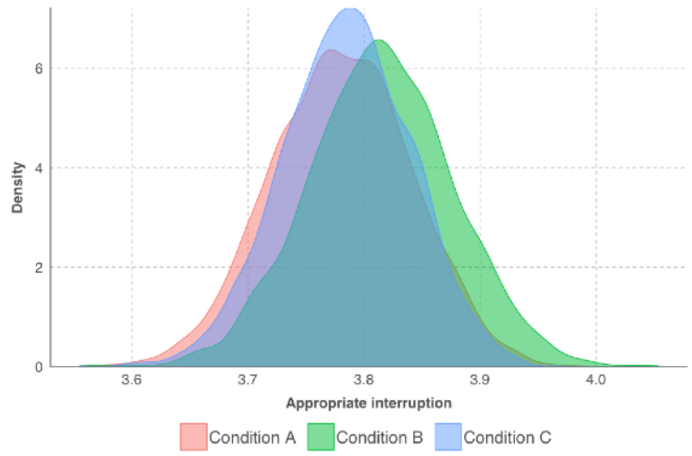
Reliability: ESM/EMA accuracy









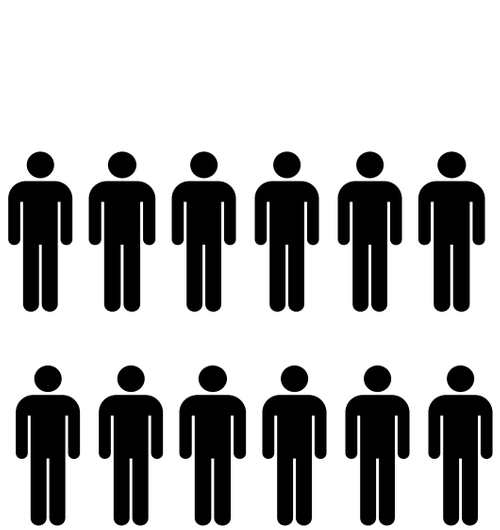


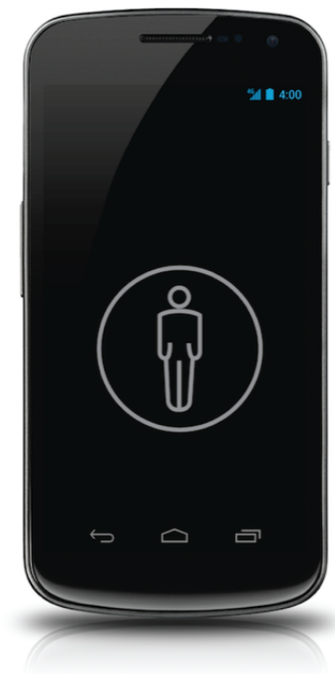
Privacy: on-board inference

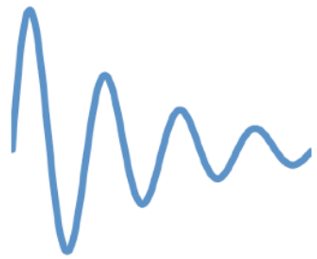
Convenience: gamification

Calculate metrics

Convenience: crowdsourcing

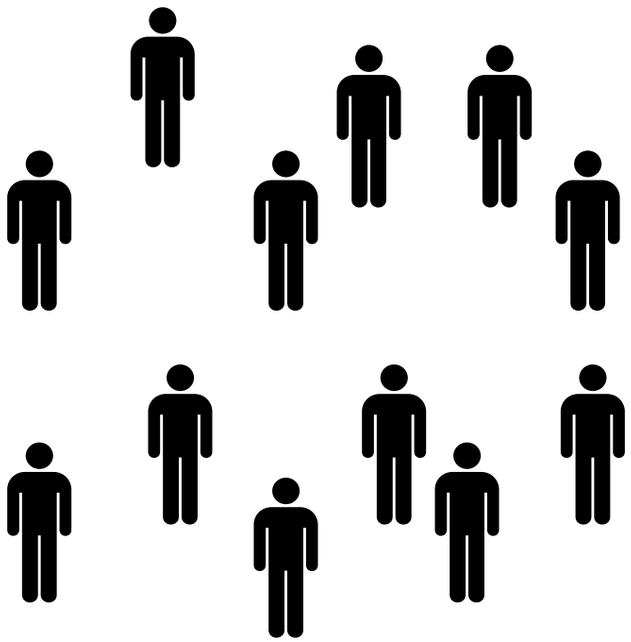


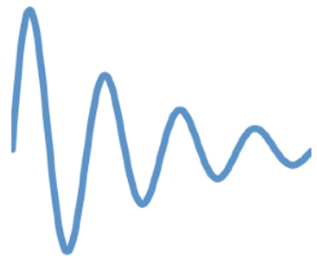




Calculate metrics

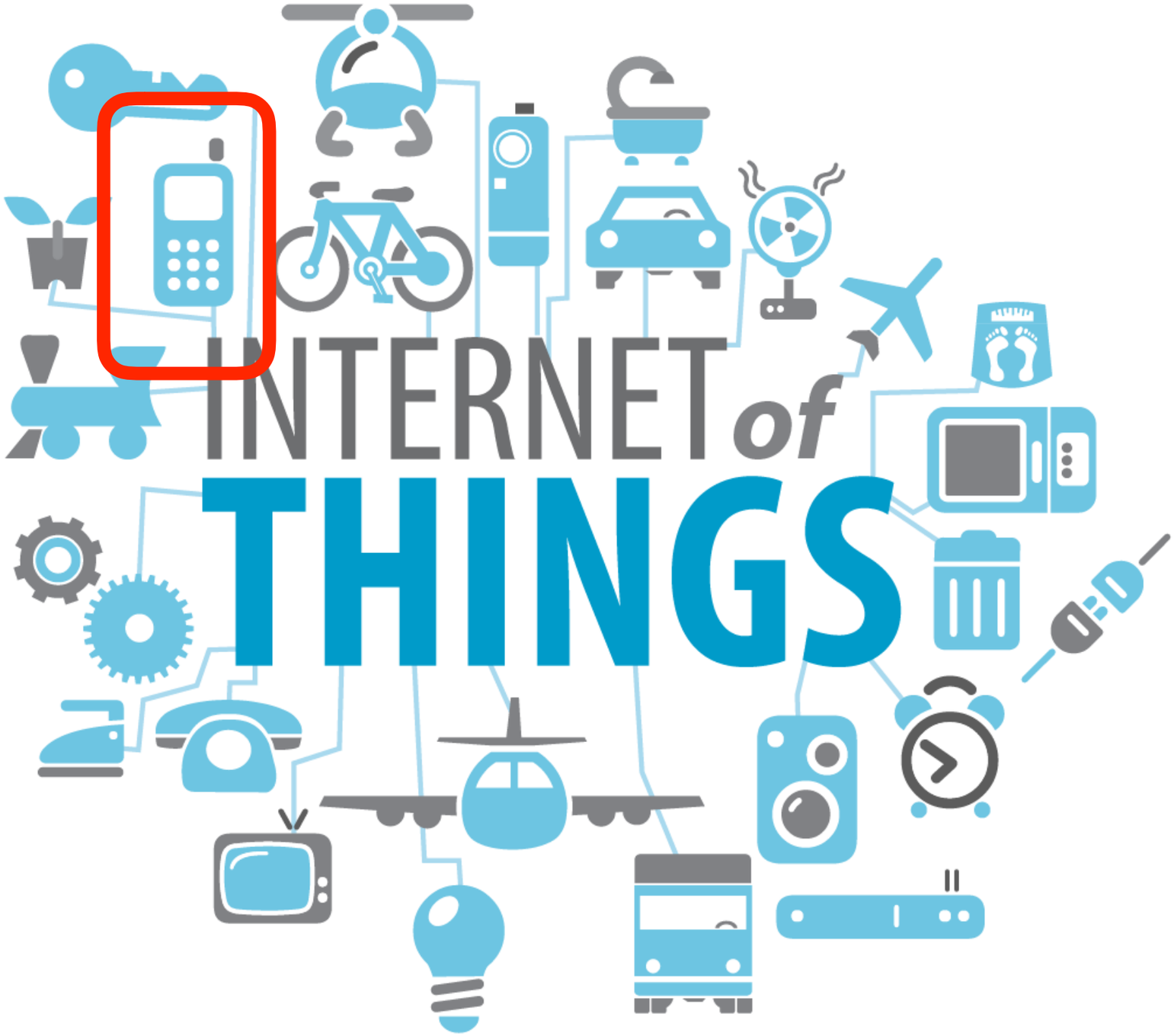
Convenience: crowdsourcing



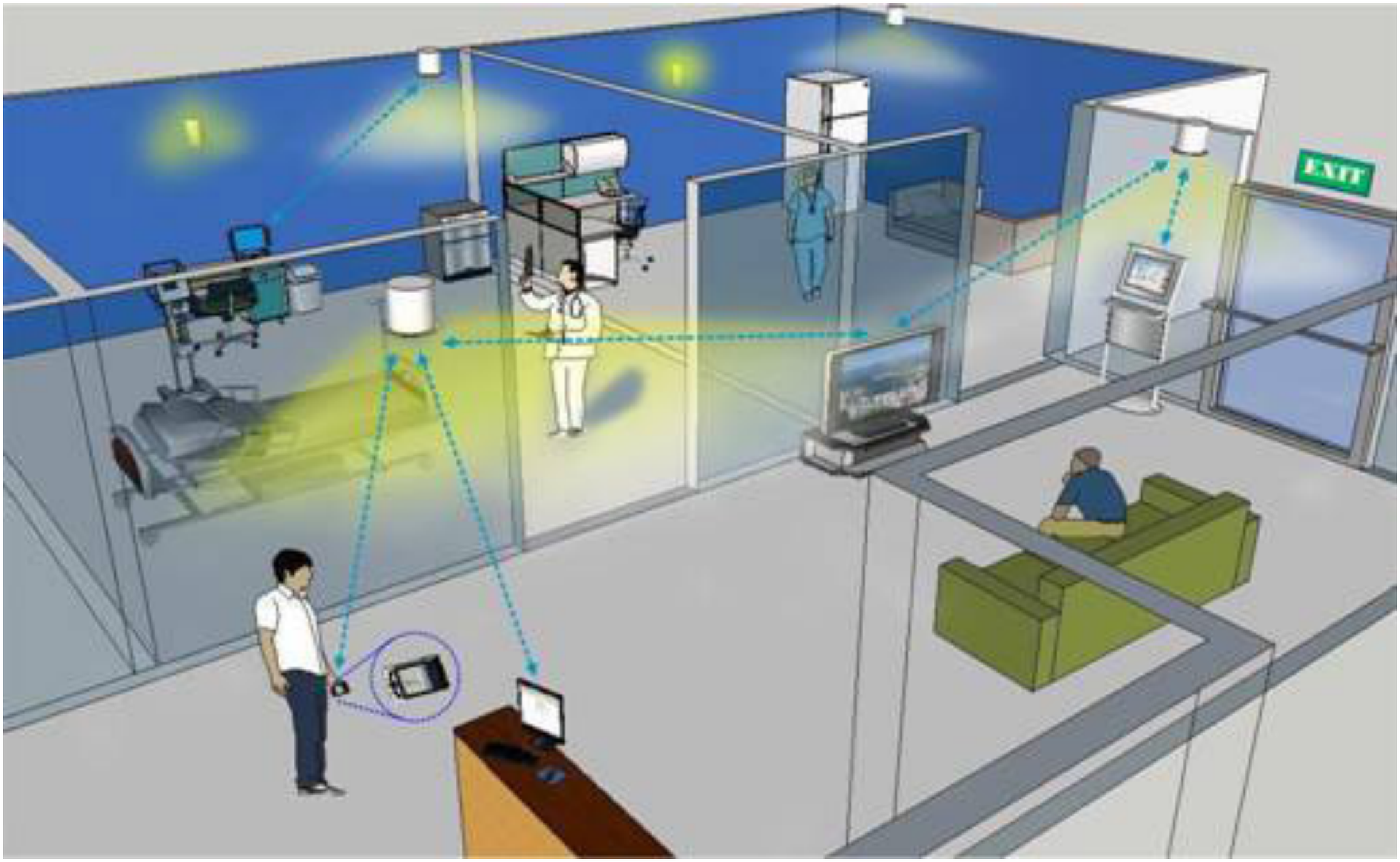


Calculate metrics

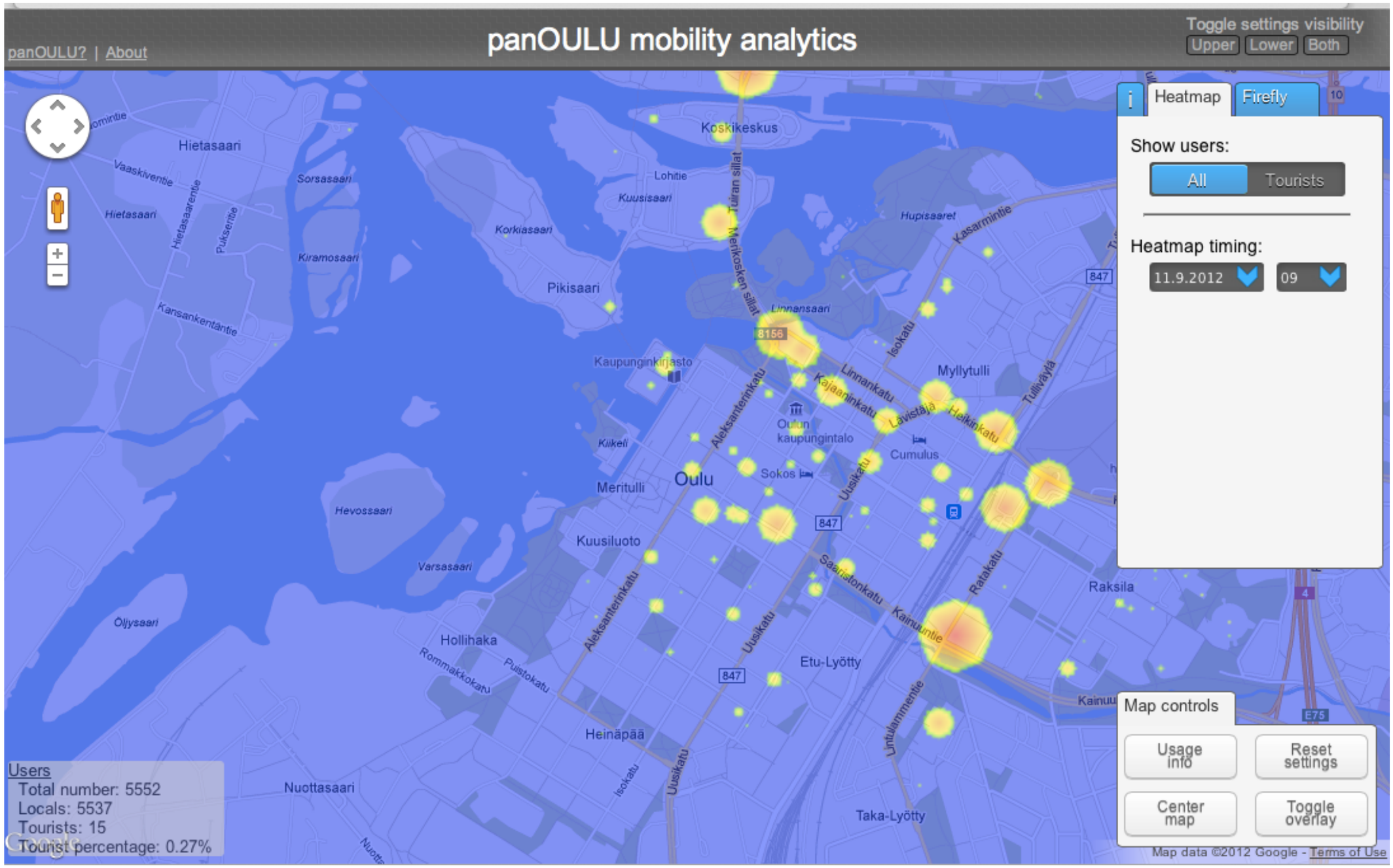
What the future holds


INTERNET of
THINGS

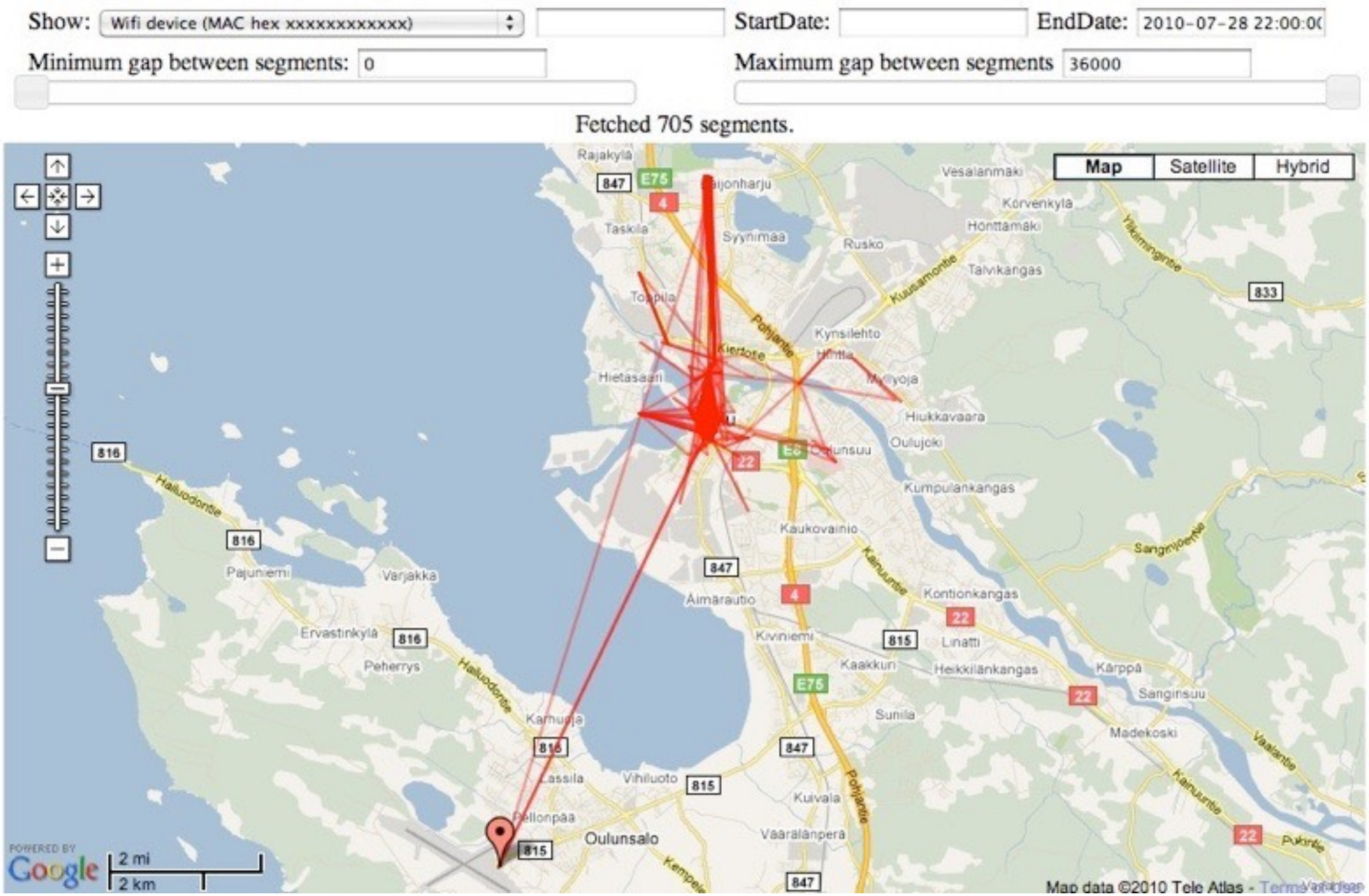
Affordability



Smart cities - public goods



Profiling people



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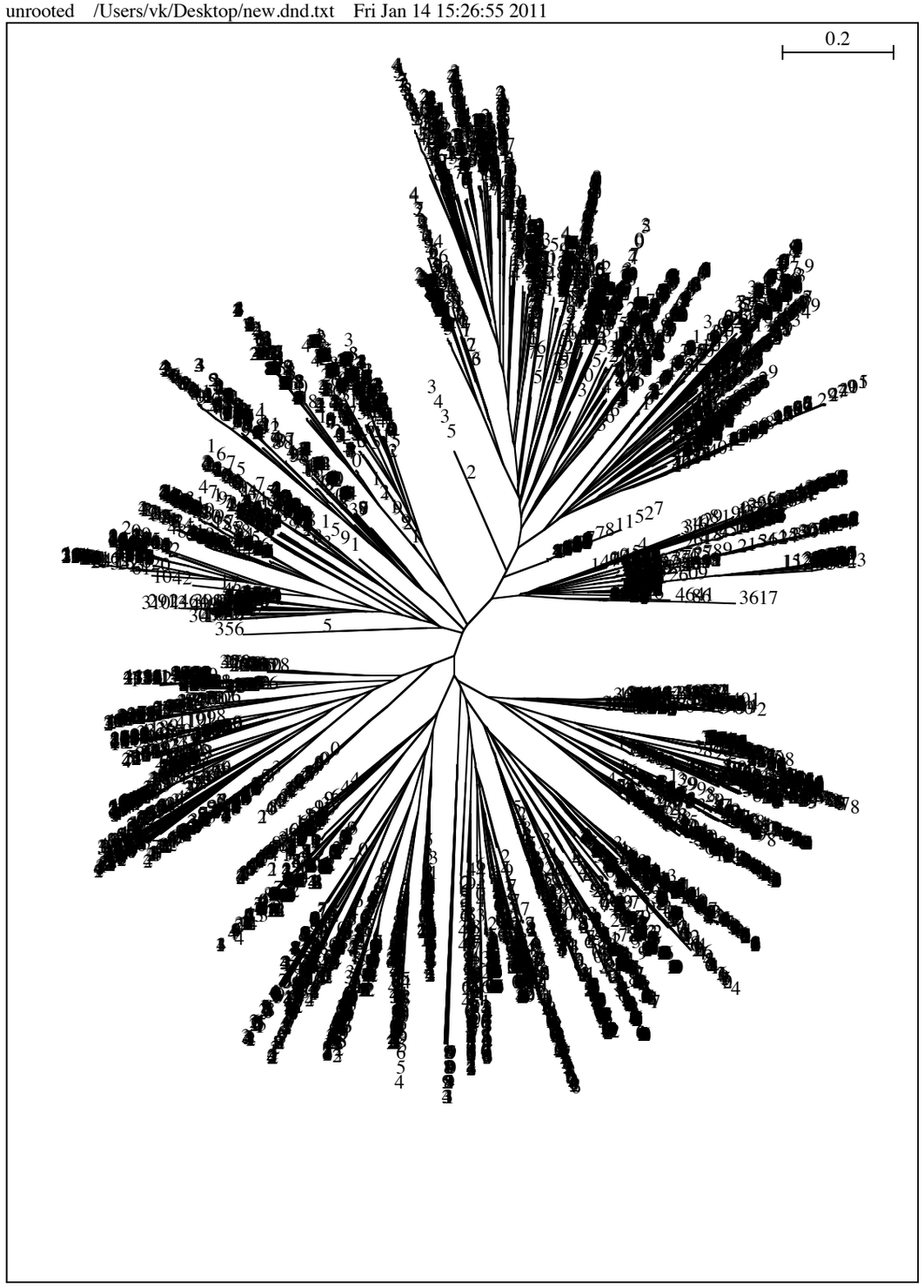
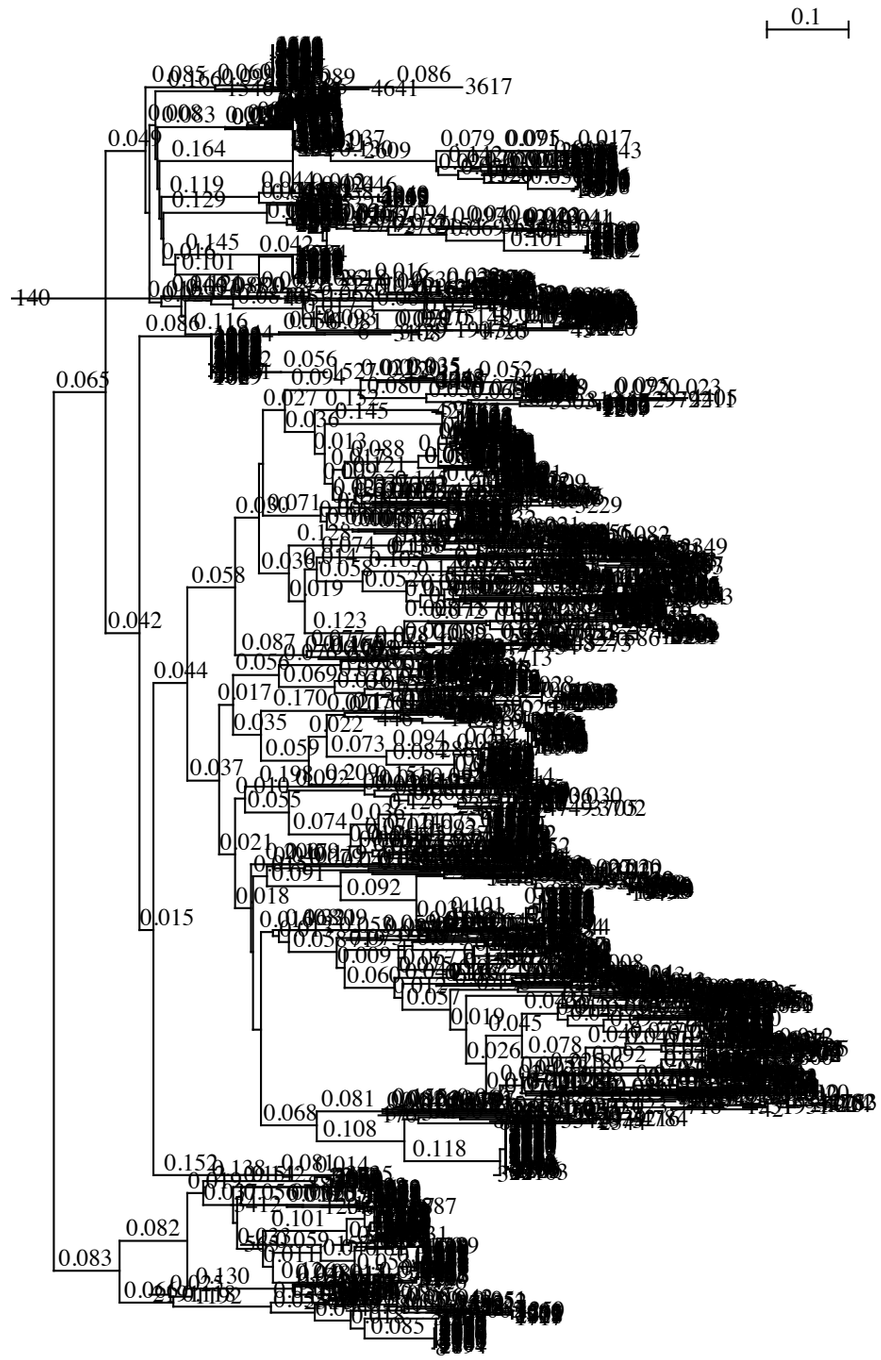
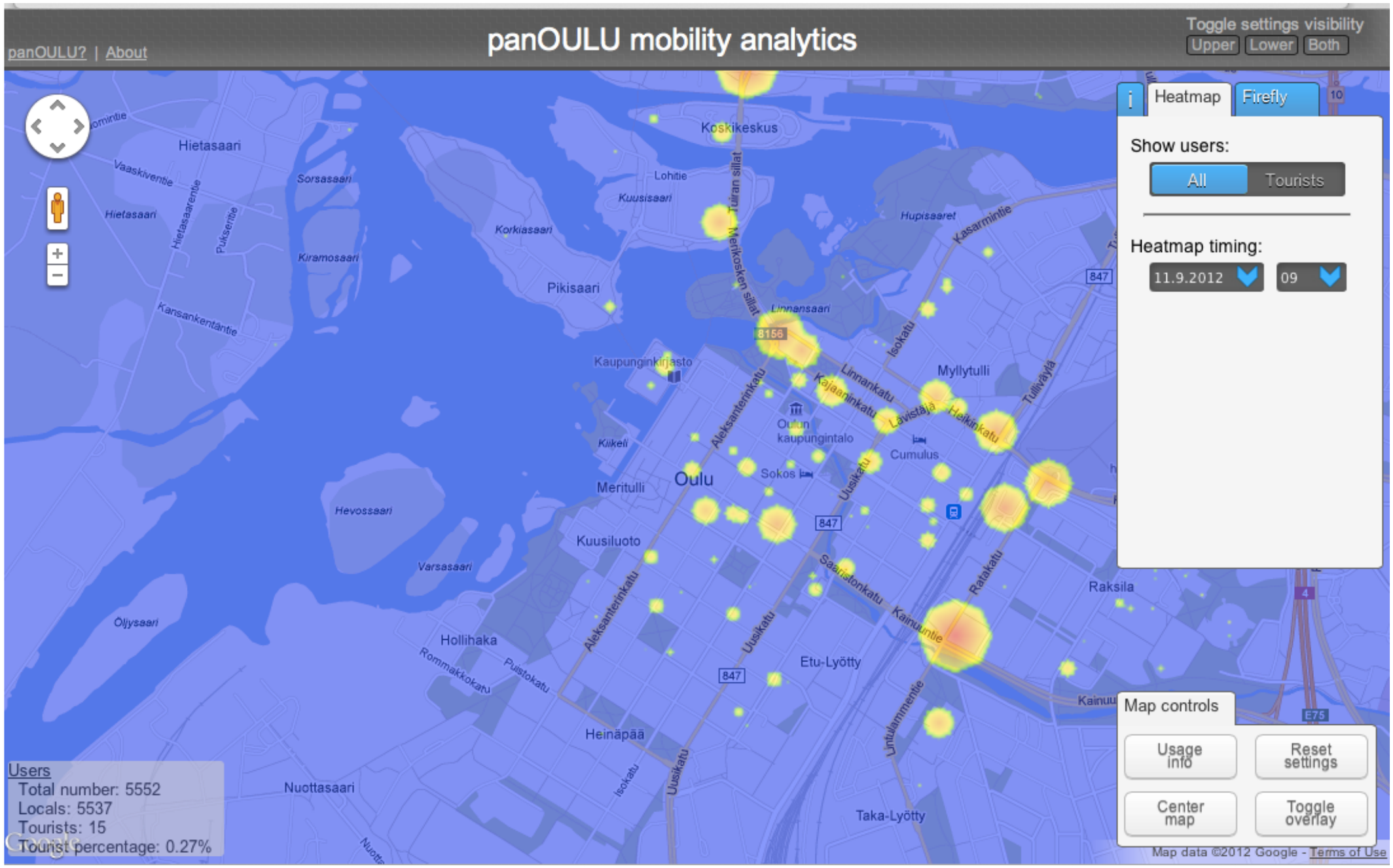




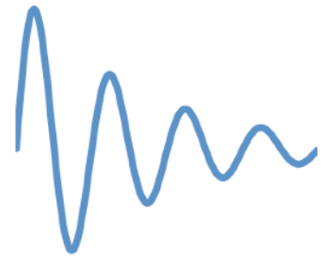
Smart cities - public goods



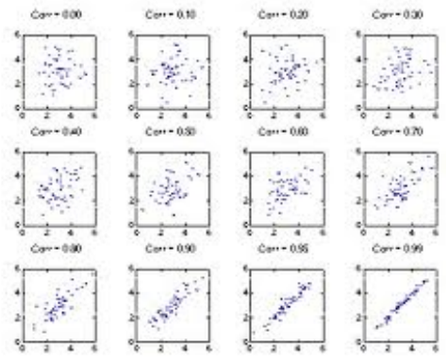
Lifestyle sensing

Modus operandi

Digital phenotype

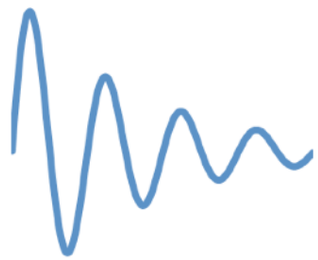


Calculate metrics



Establish correlations
Prescribe treatment

Treatments



Calculate metrics

Cool new sensors

NIRS: Near Infrared Spectroscopy

The end!

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