# Thank you, Things.

**Jo De Boeck** - *Senior Vice President and CTO imec*



## CONSUMERS DRIVE

DATA, DATA, DATA

EXABYTES PER MONTH

2012 2017

## ACCESS TO DATA

STIMULATES MANY INDUSTRIES

## PLATFORM

ENABLES NEED CREATION

TOUCH

HUMIDITY

AMBIENT LIGHT

TEMPERATURE

RF ENHANCEMENT

PROXIMITY

COMPASS

MICROPHONE

PRESSURE

LOCATION

GYROSCOPE

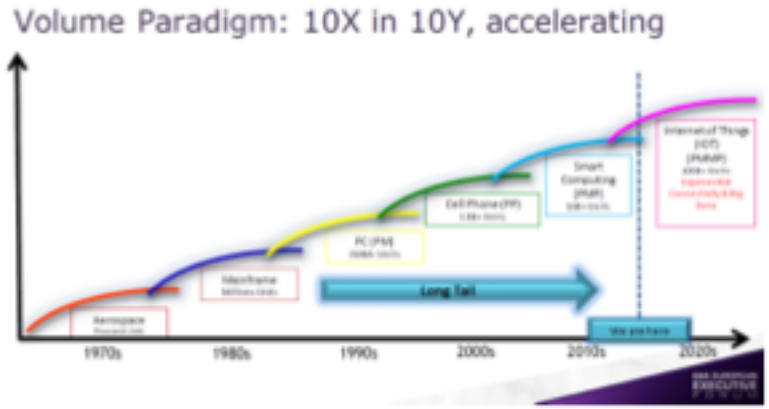
ACCELEROMETER

## SUPPORTIVE

AWARE PROACTIVE SERVICE

## THE NEXT WAVE
OF CONSUMER
## NEEDS

## NEXT DRIVER




## INTERNET OF THINGS CHALLENGES

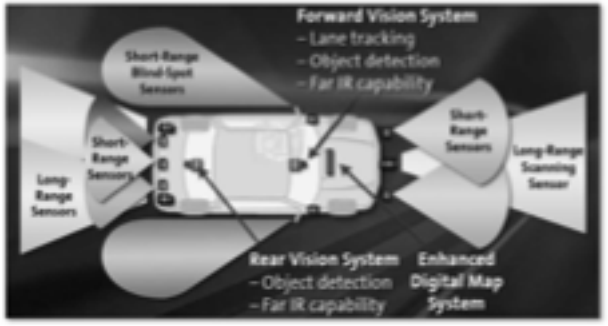
ULTRA LOW POWER

INTEROPERABILITY

MASSIVE DATA PROCESSING

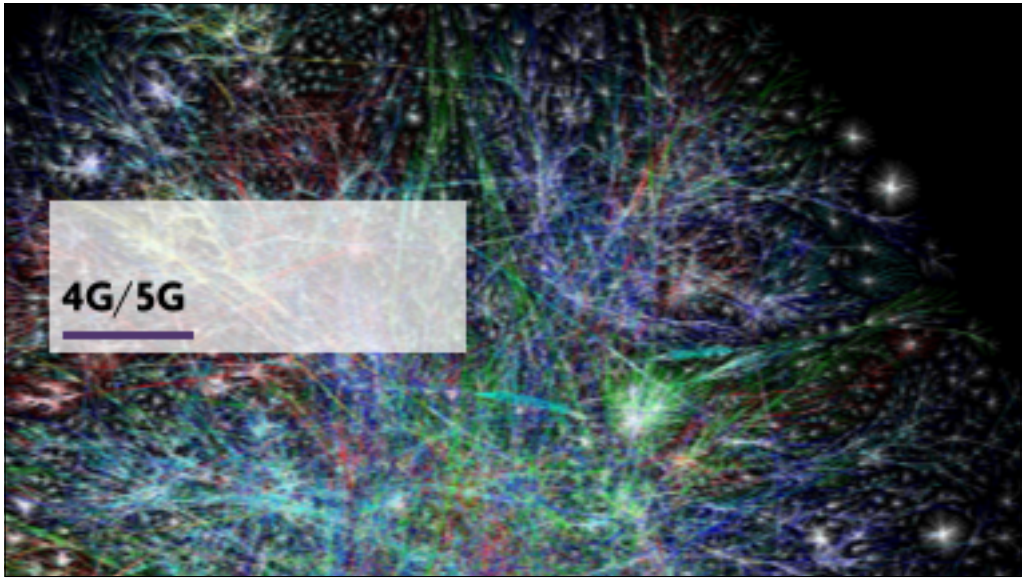
EASE OF USE

## AUTOMOTIVE
SMART MOBILITY





NEXT-GENERATION
**WIRELESS**



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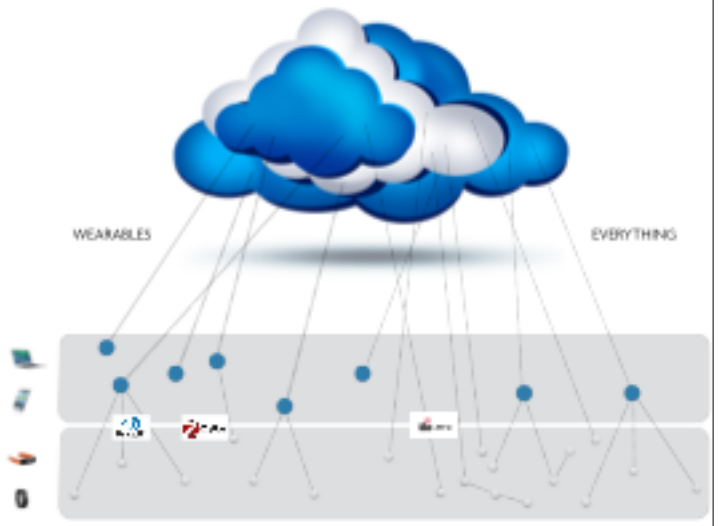
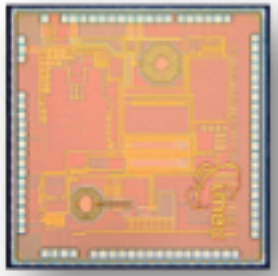






RECORD LOW POWER 4mW RX
10X BETTER THAN OFF THE SHELF

BEST IN CLASS PERFORMANCE:
-120dBm SENSITIVITY

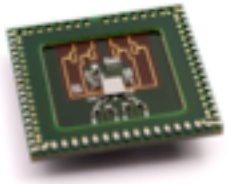
MULTI-STANDARD

HIGH LEVEL OF INTEGRATION

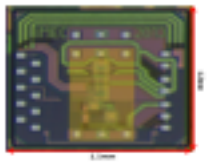
LOWEST POWER: ACTIVE AND DEEP SLEEP

>1KM DISTANCE

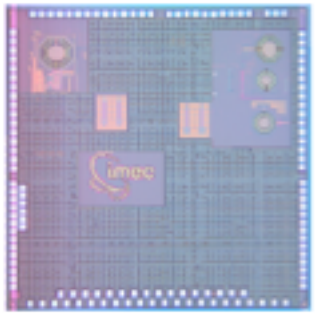
PRE-STANDARD COMPLIANT SYSTEM
IEEE 802.11ah

60GHz PHASED ARRAY RADIO
TECHNOLOGY IN 28nm CMOS



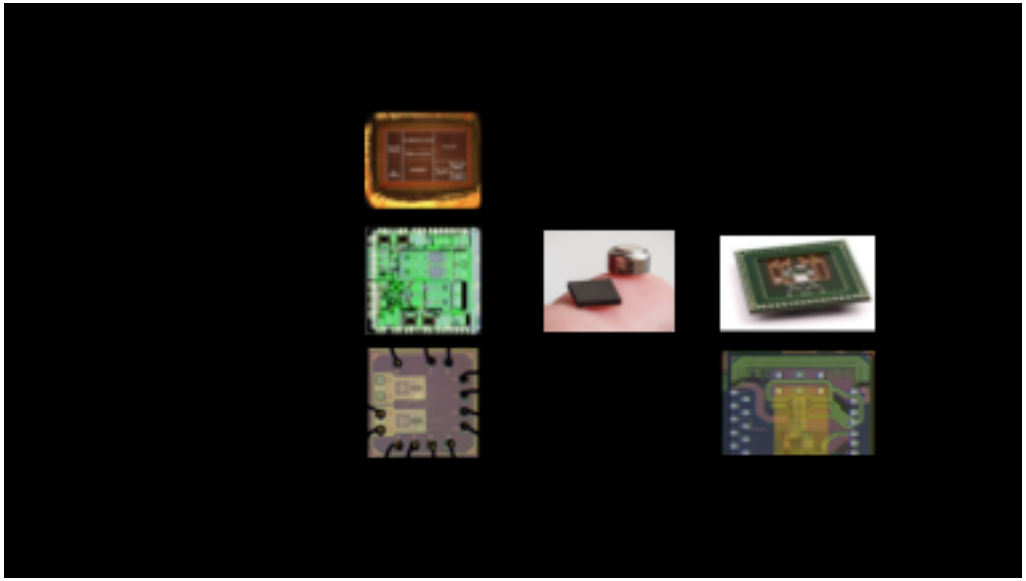
79GHz RADAR TX
IN 28nm CMOS

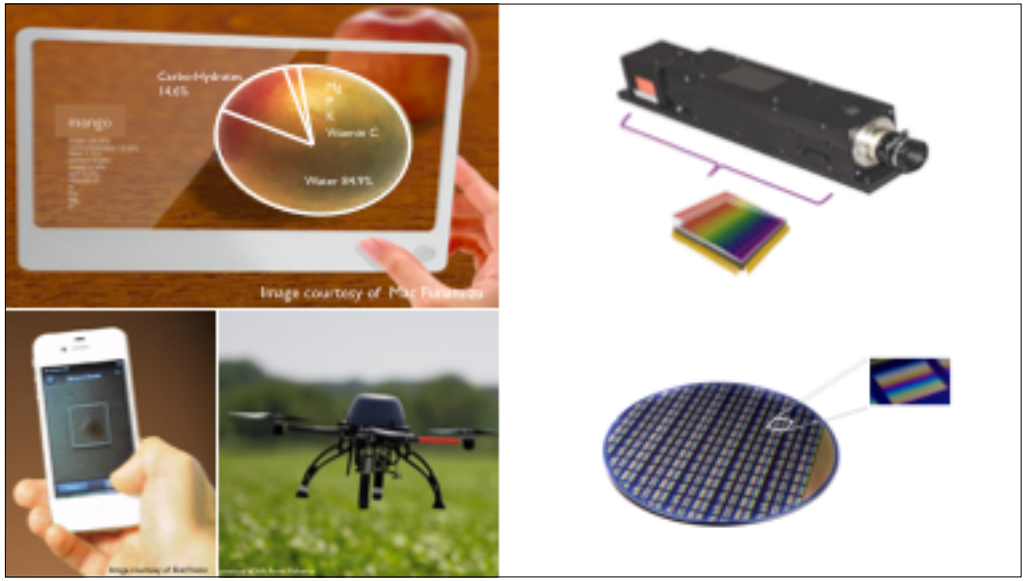


RECORD LOW POWER 5mW
2X BETTER THAN OFF THE SHELF

STATE-OF-THE-ART PERFORMANCE:
-95dBm SENSITIVITY

MULTI-STANDARD




## Hyperspectral imaging platform

**Linescan**
'wedge' design

**Snapshot tiled**
'area' design

**Snapshot mosaic**
'pin-pixel' design

**Industrial**
high resolution,
fast & flexible

**Handheld**
compact,
user-friendly

**Consumer**
extremely compact,
robust, specialised

Adimec · BaySpec · 3D-ONE · ximea

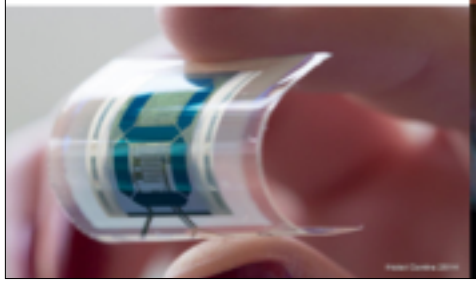
## RETAIL AND LOGISTICS
SMART RFID TAGS

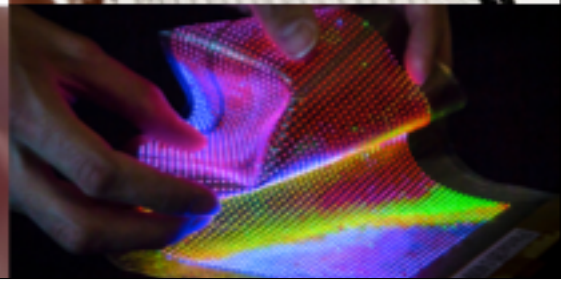
## COMPANION DEVICES
SMART RFID TAGS

## RETAIL
## AND LOGISTICS
SMART RFID TAGS

## RETAIL
## AND LOGISTICS
SMART RFID TAGS

## PLATFORM ?
MULTI-FUNCTIONALITY
HETEROGENEITY
MANUFACTURABILITY
DESIGN
ECOSYSTEM



## PLATFORM ?
MULTI-FUNCTIONALITY
HETEROGENEITY
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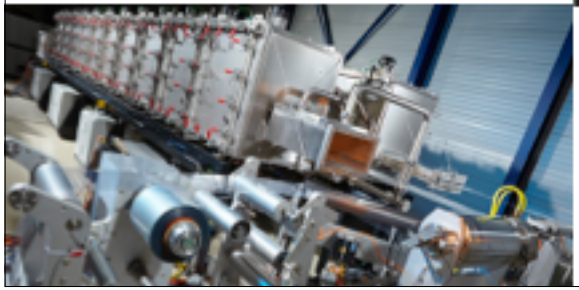
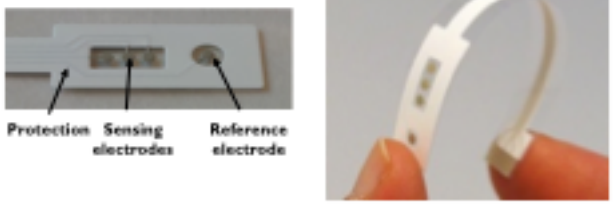
ECOSYSTEM



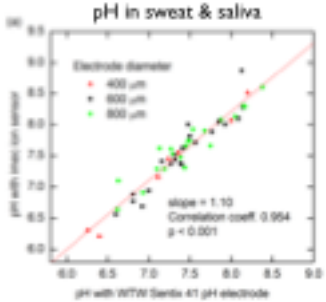

## Multi-ion 'one-drop' analysis platform

- Multiple ions: pH, $Cl^-$, $Na^{+}$, $K^{+}$
- 2-10 pH range, 0.1 – 1 M $Cl^-$ range



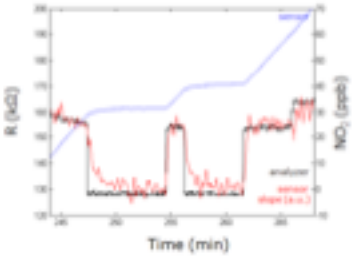


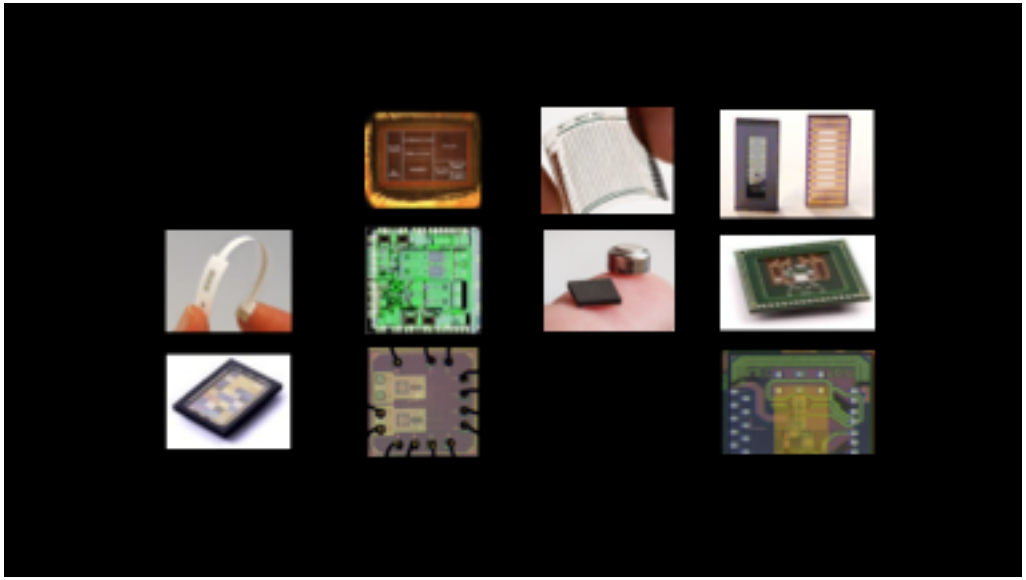

pH in sweat & saliva




## Multi-gas analysis platform

- **2 ppb limit of detection**
- <200mW active mode power consumption
- High selectivity
- Continuous measurements
- Multi-gas sensing: $NO_2$, NO, O3*, NH3*…



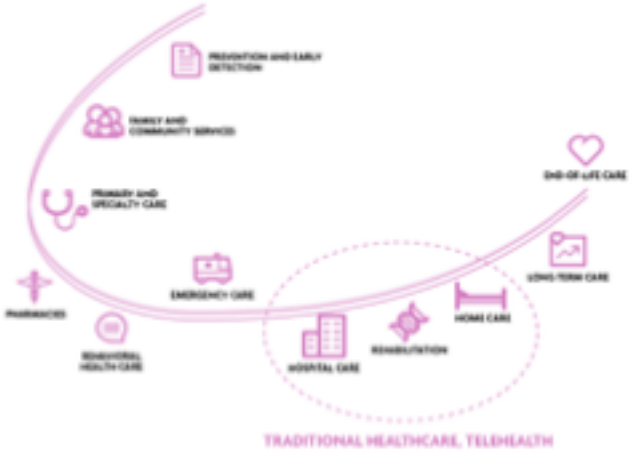






## BECOME A HEALTH COACH

CHANGE YOUR LIFE

MOVING FROM
TRADITIONAL CARE TO
**PREDICTION PREVENTION**

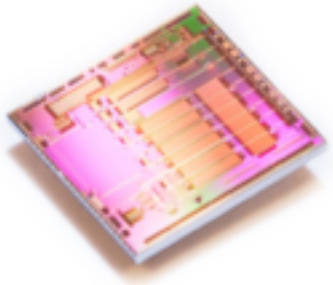



EMPOWER PEOPLE FOR
**DISEASE PREVENTION AND HEALTHIER LIFESTYLE**

**ACCURATE**

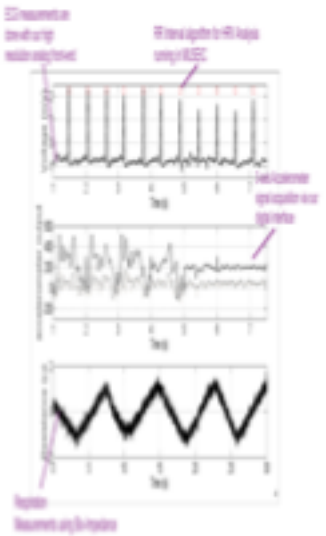
ULTRA-LOW POWER
MULTI-SENSOR PLATFORM

# MEDICAL QUALITY DATA



ULTRA-LOW POWER
MULTI-SENSOR PLATFORM


LOWEST POWER BIOMEDICAL SENSOR PLATFORM :
750uW total power consumption



SAMSUNG
# DIGITAL HEALTH PLATFORM

Samsung SIMBAND

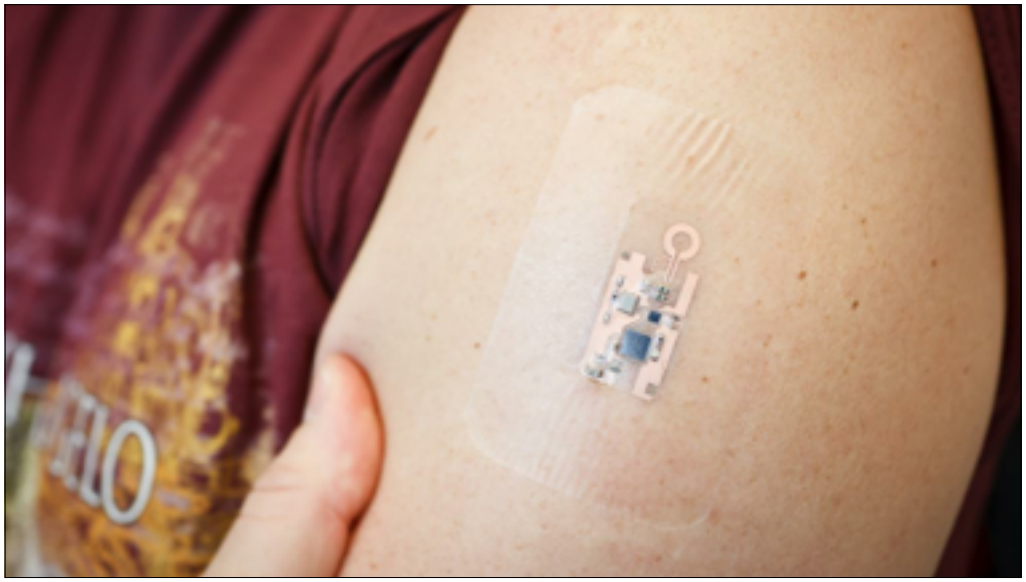
*'Investigational' device. Not available for sale.*

SAMSUNG
# DIGITAL HEALTH PLATFORM

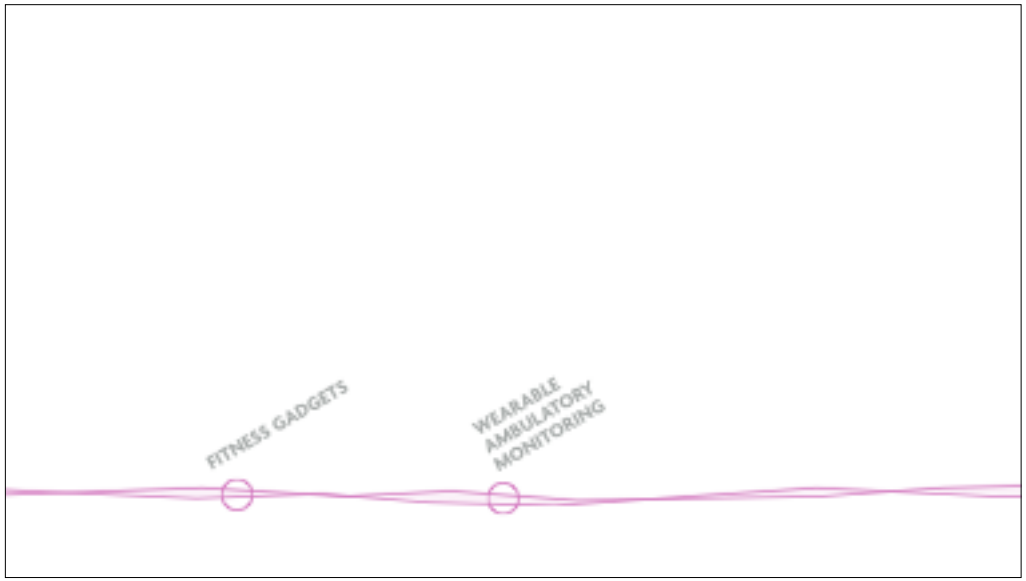

OPEN
REFERENCE
DESIGN
SIMBAND


Bloom Life
Start-up Holst Centre / imec
Incorporated 2014


ULTRA-LOW POWER
MULTI-SENSOR PLATFORM
MEDICAL QUALITY DATA



ENABLING TRUE
## MOBILE HEALTH

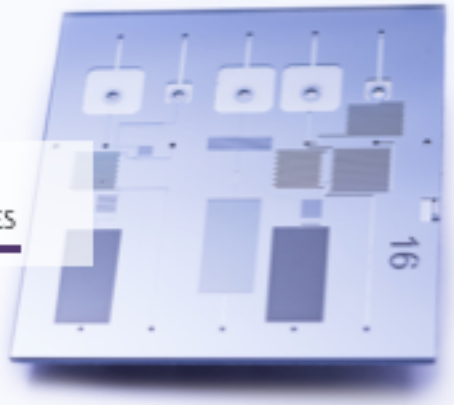




## iLAB

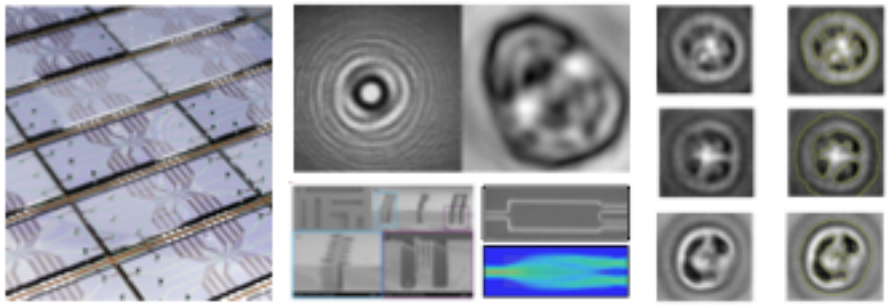
MULTIPLE TESTS UNDER 10USD

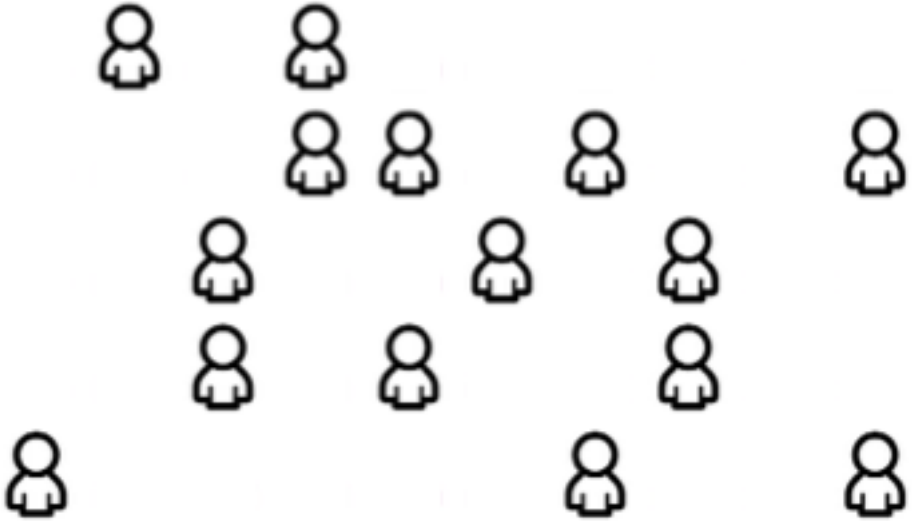
## DIAGNOSTICS

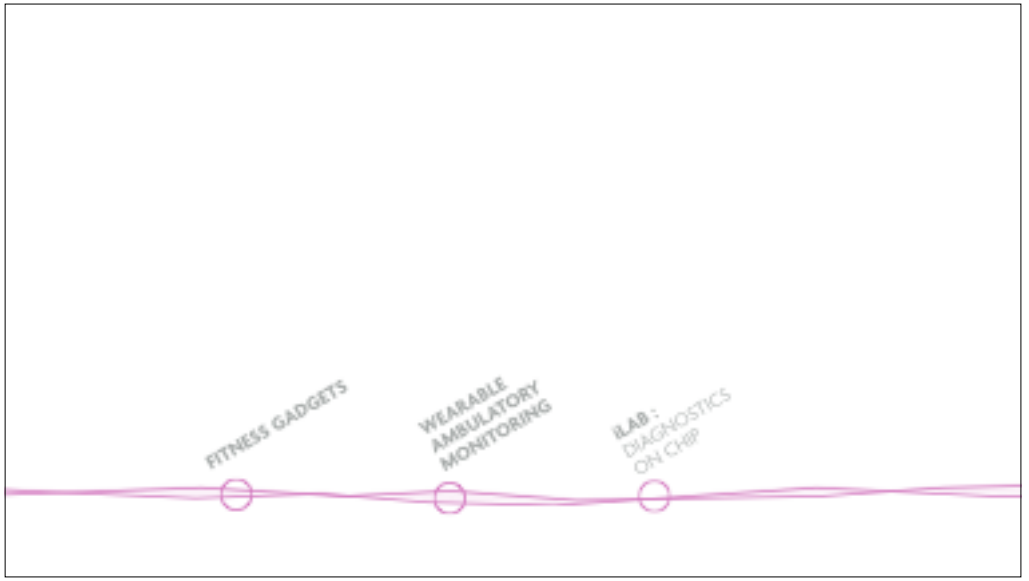
FOR INFECTIOUS DISEASES



## Diagnostics-on-a-Chip platform

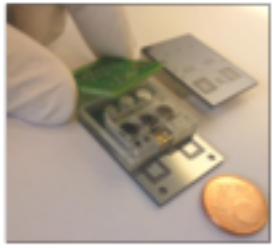


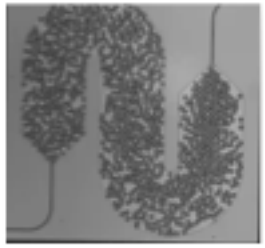


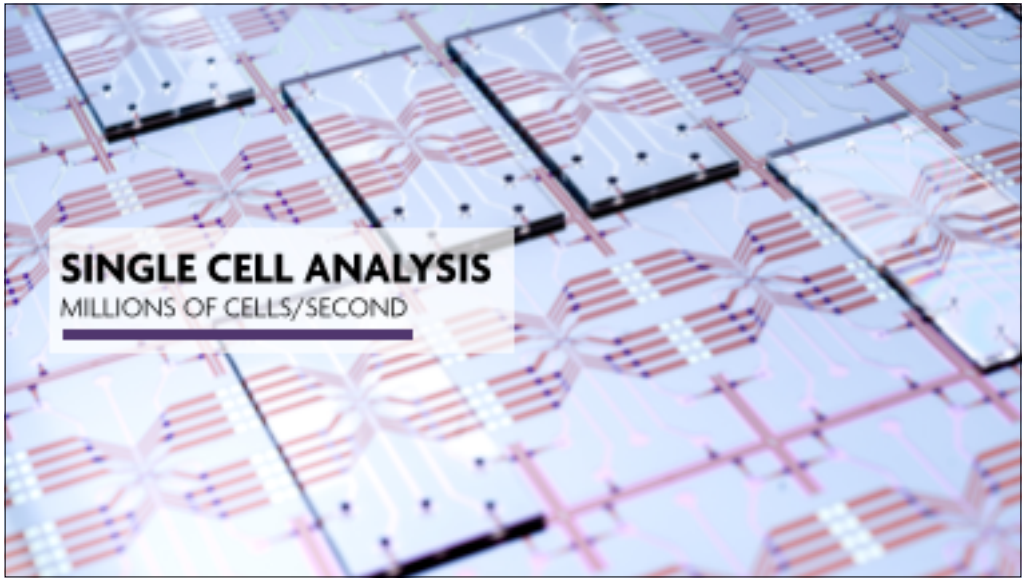


## On-chip genome analysis platform

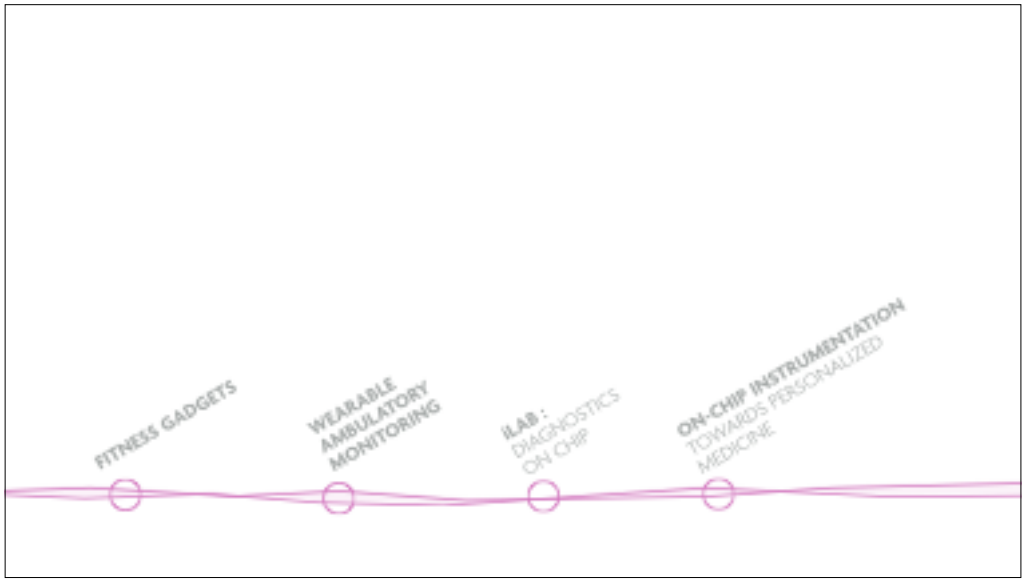





SINGLE CELL ANALYSIS
MILLIONS OF CELLS/SECOND

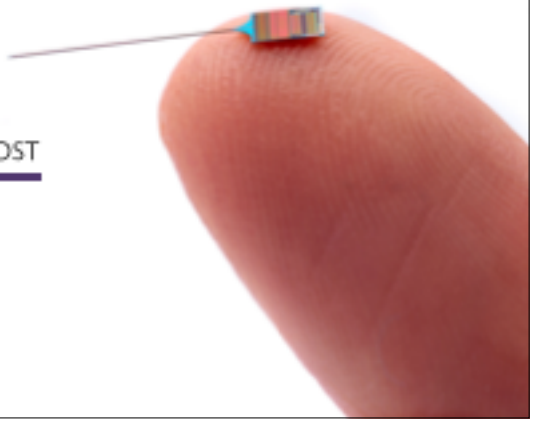

SINGLE CELL ANALYSIS
MILLIONS OF CELLS/SECOND


CANCER TREATMENT


FITNESS GADGETS
WEARABLE AMBULATORY MONITORING
iLAB : DIAGNOSTICS ON CHIP
ON-CHIP INSTRUMENTATION
TOWARDS PERSONALIZED MEDICINE

## BRAIN PROBES

COMPACT & INTELLIGENT & LOW COST

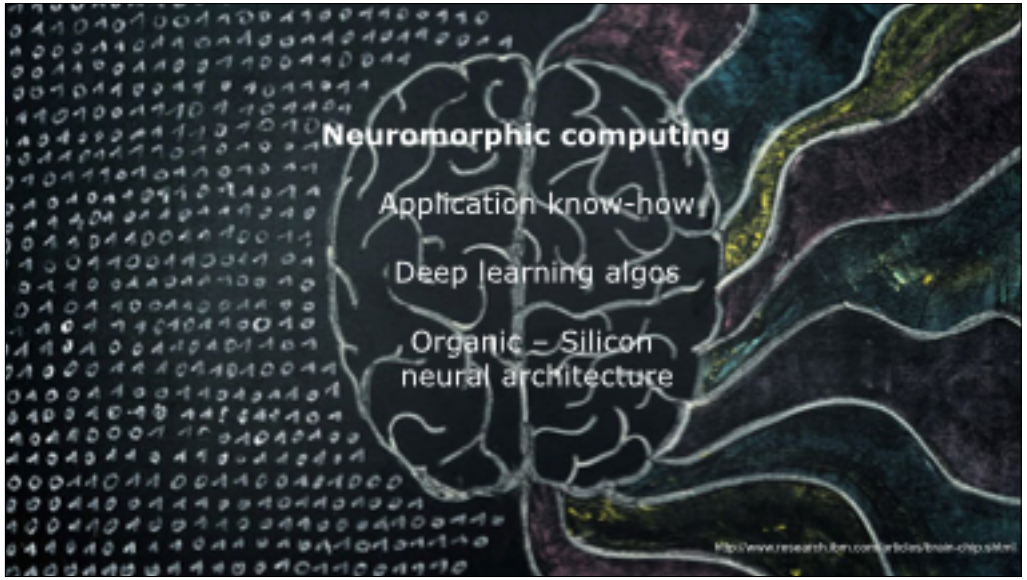


## Neuron interface platform

Signal filtering (LFPs ,APs)
Analog-to-digital conversion
Digital interface to small PCB
Direct link to PC

100 µm x 50 µm shank
456 electrodes and amplifiers
52 channels
Low noise: 4µV rms
Recording + stimulation



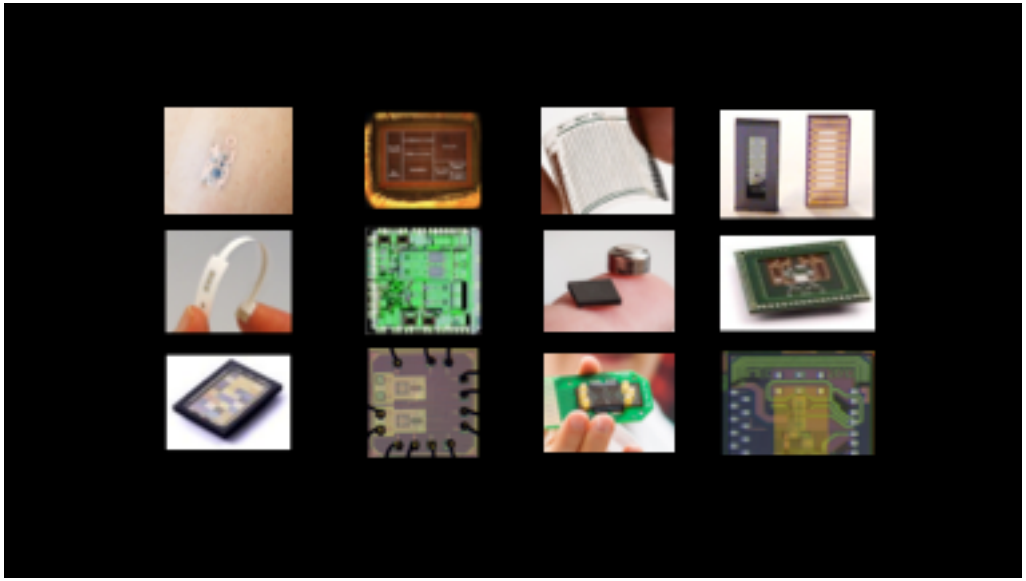



INTERNET OF
**EVERY** THING

PERSON CENTRIC

VEHICLE CENTRIC

INFRASTRUCTURE CENTRIC



Thank you, Things