

## Efficient energy use of local and remote data processing

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# Perfect Storm

Lower Power device IoT

The cost of connecting  
and technology are  
going down

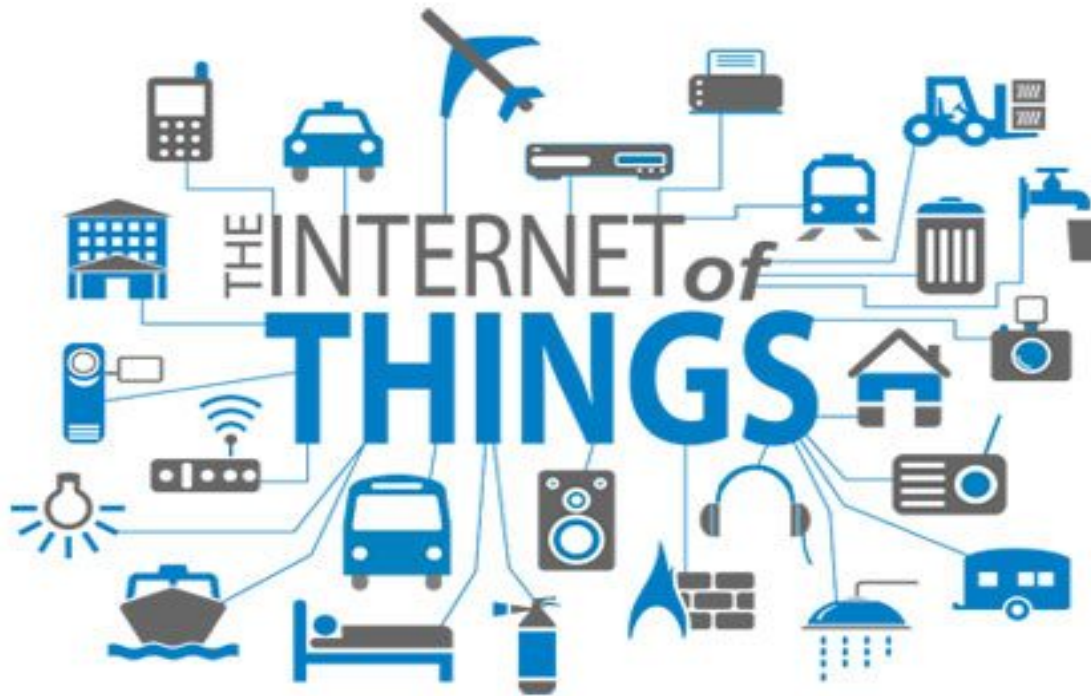


More devices are  
being created with  
Wi-Fi capabilities  
and sensors built  
into them.

Smartphone  
penetration is  
sky-rocketing



Broadband Internet  
is become more  
widely available.

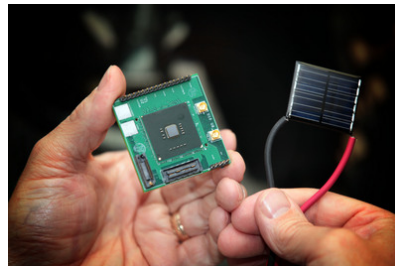
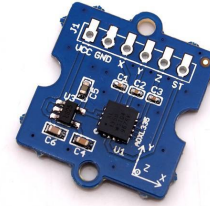


## IOT

Network of physical devices, with electronics, software, sensors, and network connectivity which enable these objects to connect and exchange data.

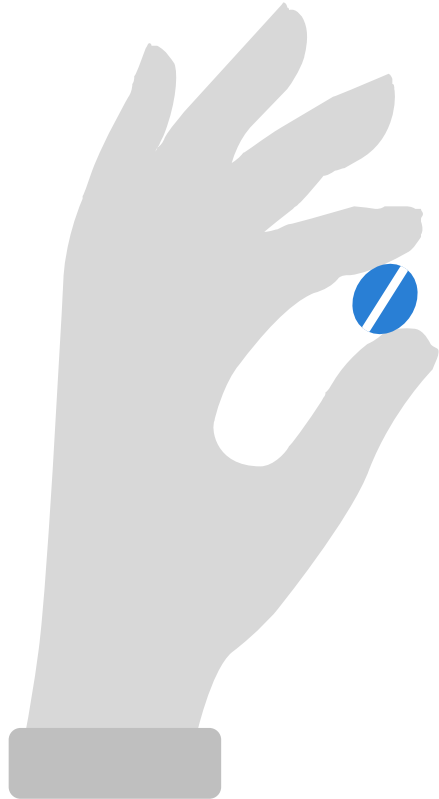
# Where can we find it?

It is everywhere



# The Problem

## Lower Consumption Optimization

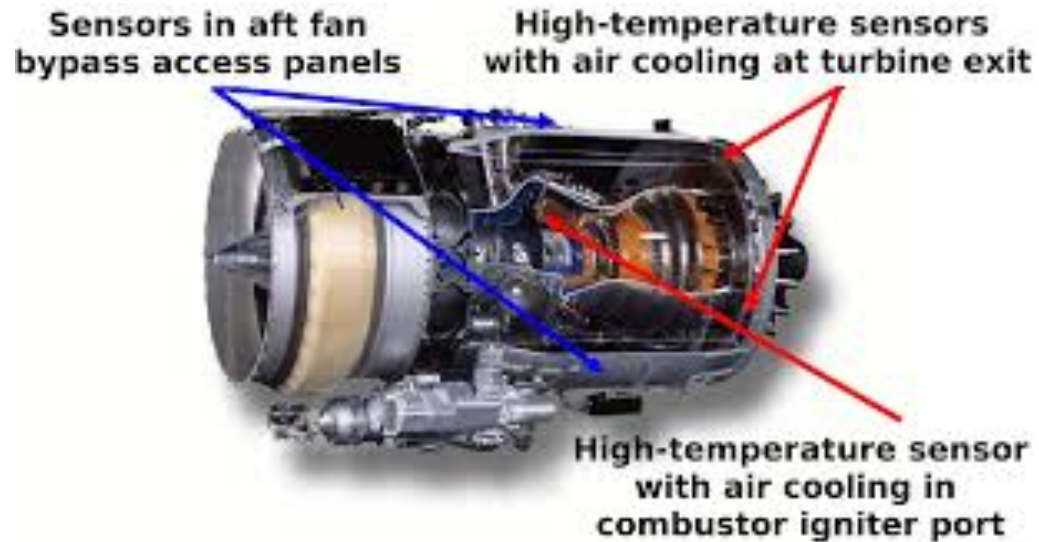


The full potentials of new wireless technology in the case of power saving has not been reached.

There are different reasons that affects the power consumption, one of them is that the full data processing is not optimally distributed between the sensor and the host .

# Unbalance competition.

## Jet engine example



The jet engine fitted with 5,000 sensors can generate up to 10 GB of data per second.

# What we will do:

We will implement a simple NLA data processing algorithm and compare the efficiency of it when:

We process the data in the host



We process the data in the smart sensor

# Algorithm

Matrix-by-matrix product is the **core** for almost all efficient algorithms in linear algebra. (NLA Lecture 3, Ivan Oseledets)

Language: C 99

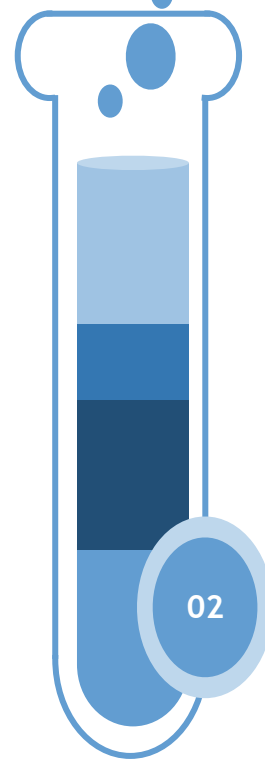
Library: arm\_math.h

## BLAS 2

matrix-by-vector

$$A * v = v'$$

$O(n^2)$  data  
 $O(n^2)$  operations

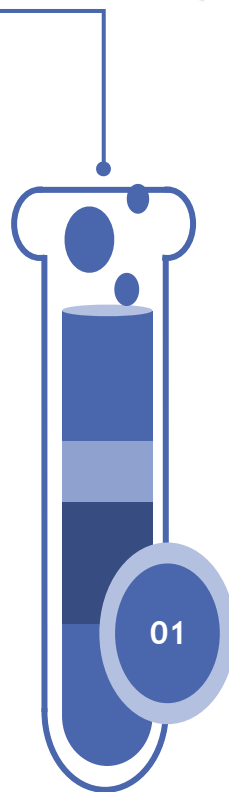


## BLAS 1

$$A + B = C$$

$O(n)$  data

$O(n)$  operations

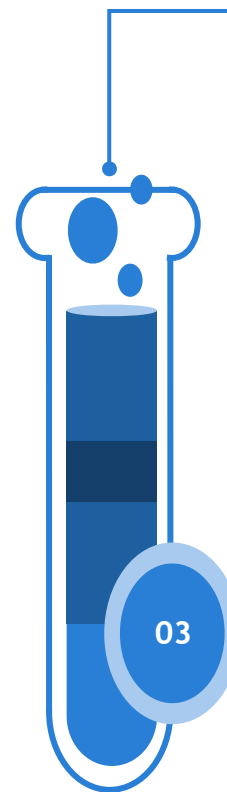


## BLAS 3

matrix-by-matrix

$$A * B = C$$

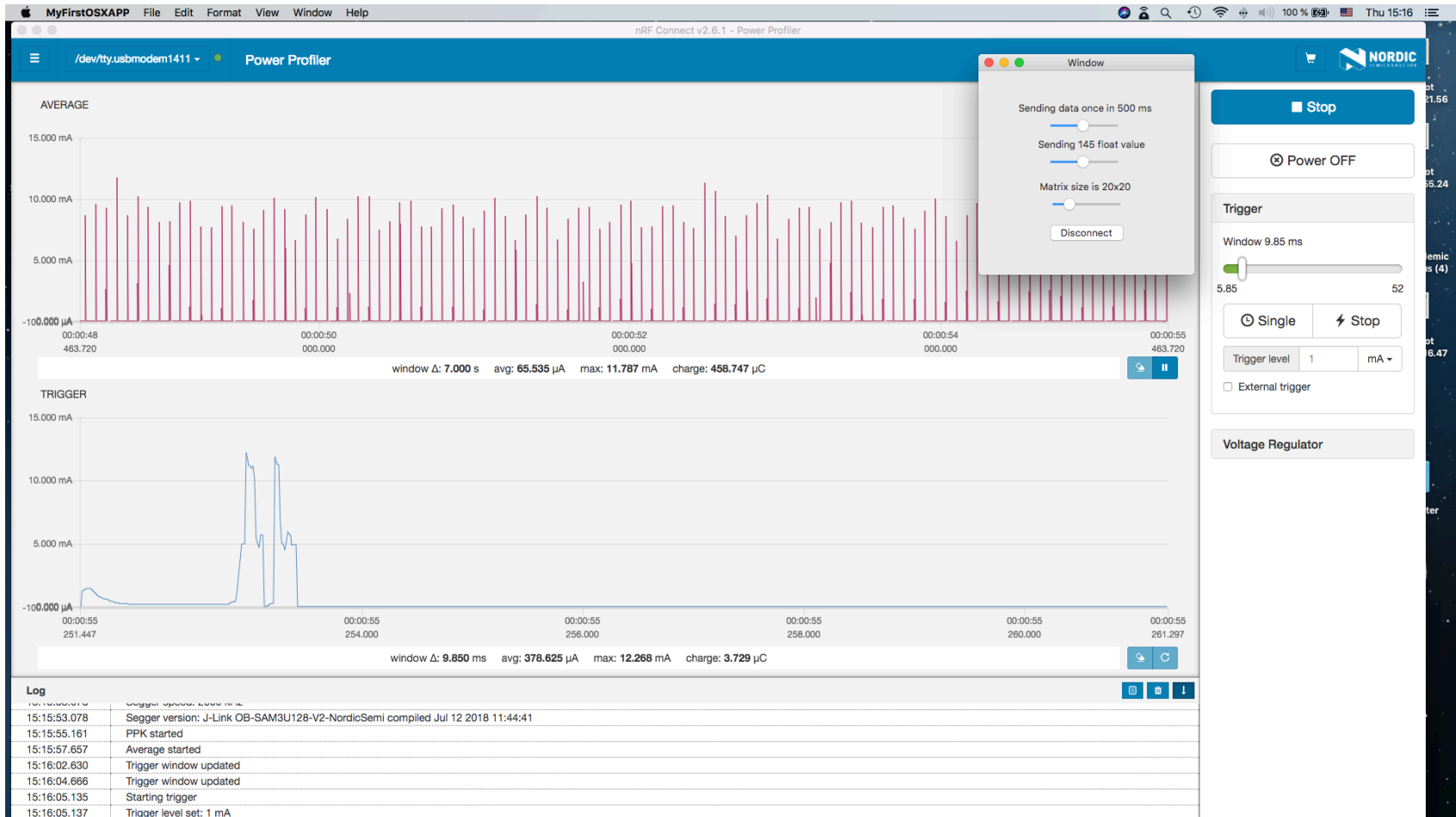
$O(n^2)$  data  
 $O(n^3)$  operations





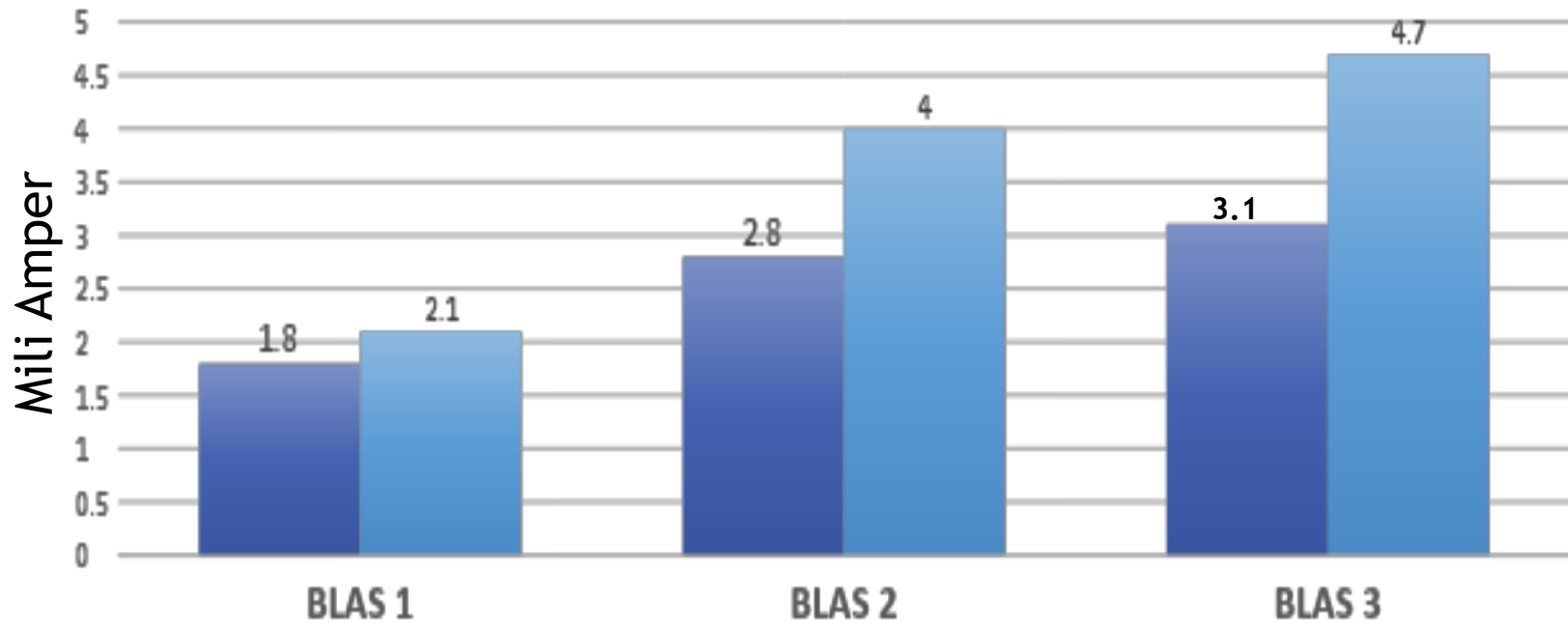
# Methodology:

Nrf52-dk + Power Profiler Kit nRF6707



# Results

## Power Consumption



Local  
Processor

Remote  
Processor

# Conclusion & Future Steps

01

By processing the data in a local way we can save from 1 to 1.5 years of battery life time .

02

In base of the results we can select the most optimal way to process data according to the characteristics of the task and do it in an efficient way.

03

As future steps, we are hoping to find a criteria of effective data processing allocation.



# Sensor to use:

CC2650 Wireless MCU

Contains sensors for:



Gyroscope



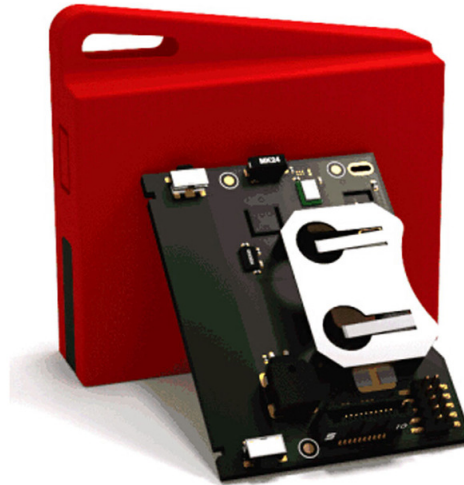
Temperature



Digital  
Microphone



Light



Accelerometer



Pressure



Humidity



Magnetometer

