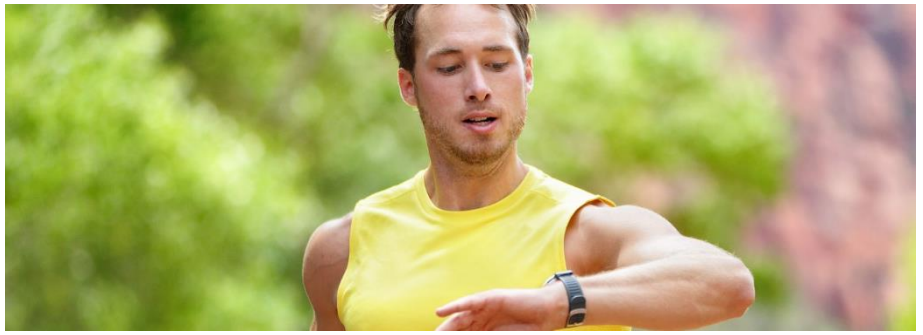
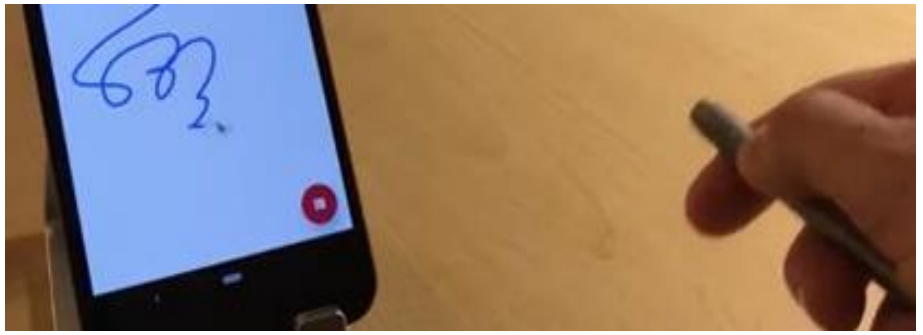
LSM6DSO

ST New 6-axis IMU





Wrist Tilt detection

Smart Pen

360 Lid angle detection

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Wrist Tilt Detection

Bring the computing to the edge

High accuracy thanks to the LSM6DSOX IMU

Finite State Machine Feature

Machine Learning Core capability

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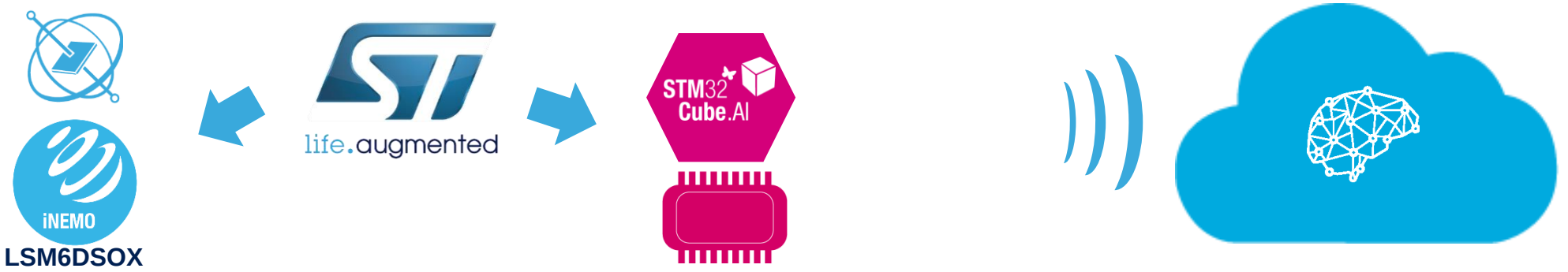
Bring the Computing to the Edge

And reduce tremendously the overall power consumption



Data processing inside the sensor:

- Local processing
- Real time analysis
- Reduced cost of bandwidth
- Ultra Low Power
- Intrinsic Security
- Configurable Logic
- Simple computation (Dec. Tree)

Data processing inside the STM32:

- Local processing
- Real time analysis
- Reduced cost of bandwidth
- Low Power
- Improved security
- Configurable Logic
- Std Computation (Neural Net.)

Data processing inside the Cloud:

- Advanced Computation
- Availability of Wide Amount of Data
- Continuous Algo Improvement
- Remote processing
- Data Transfer Latency
- High cost of bandwidth
- Very High current consumption

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Wrist tilt detection only consumes 13uA (IMU) with MCU in sleep mode

High Accuracy

Thanks to the LSM6DSOX IMU

Improved Accuracy, Optimized System Power

High Accuracy
Noise: Gyro 3.8 mdps/√Hz
Accelerometer 70 µg/√Hz

Low Current Consumption
0.55mA HP combo
-15% vs. LSM6DSL/M

New ultra low power Axl:
14uA @100Hz ODR

LSM6DSOX

2.5x3x0.86 mm

Sensor HUB
& compressed 9kB FIFO

Embedded Pedometer 2.x
And built-in functions

OIS Stabilization Core

New Standard Protocol
I3C / I2C / SPI

Finite State Machine &
Machine Learning Core

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P2P with LSM6DSL, LSM6DS3, LSM6DSO, SW compatible

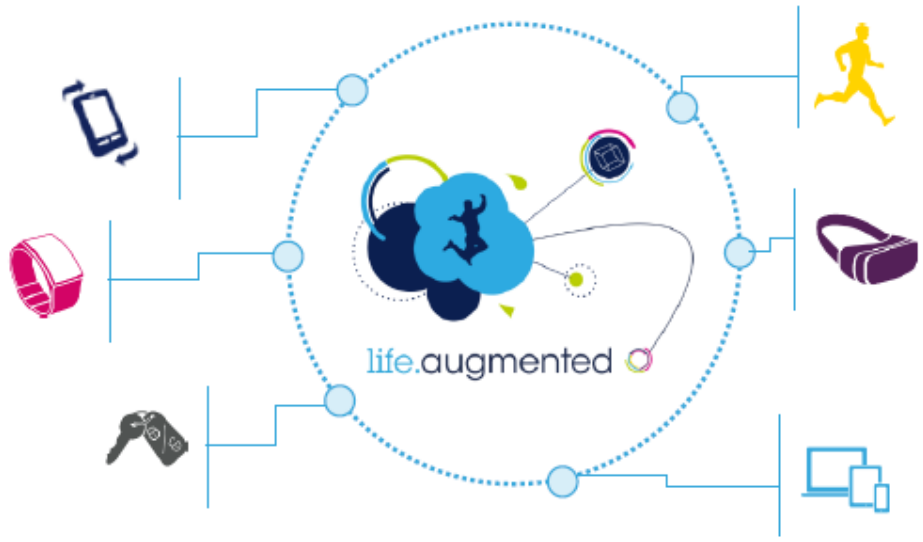
Finite State Machine

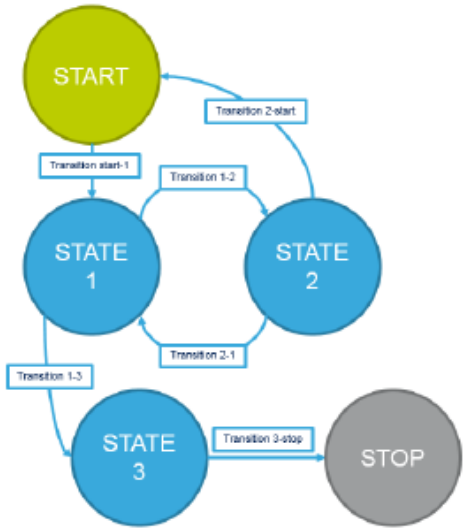
for Simple Activity Recognition

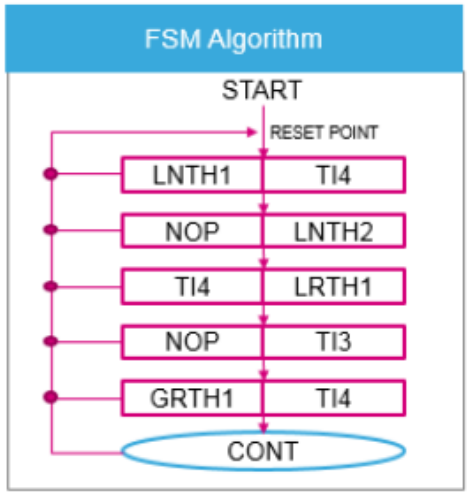
LSM6DSOX : the first IMU with embedded machine learning cores and FSM

Each FSM is intended to detect a single specific gesture.

- Wrist-Tilt
- Free Fall / Shock Detection
- Pick-Up
- Wake-Up
- Twist / Shake
- Glance
- Motion / Stationary
- 4D / 6D
- Flip-Up / Down
- … and others!







Easy and Effective Application Development

- STM gestures database available
- High level of customization
- Ultra low power

~3uA for each FSM @ 26Hz

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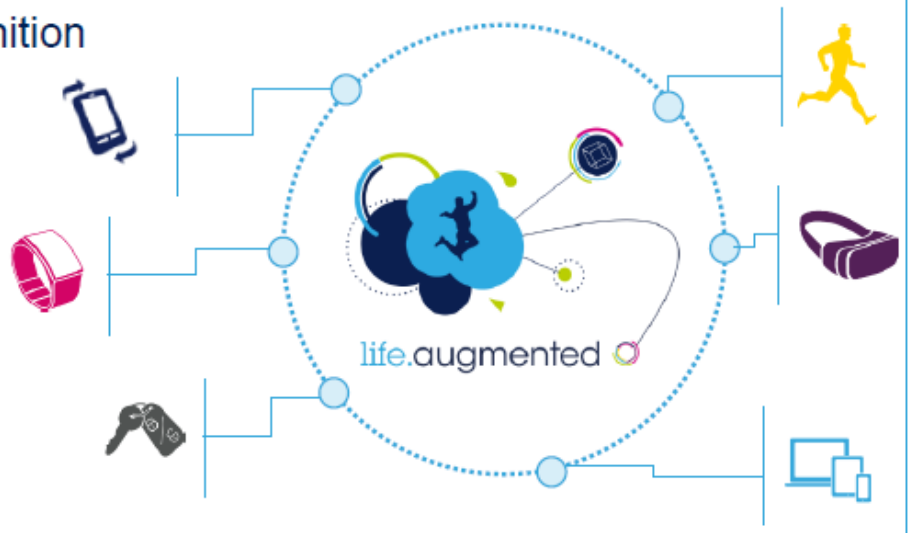
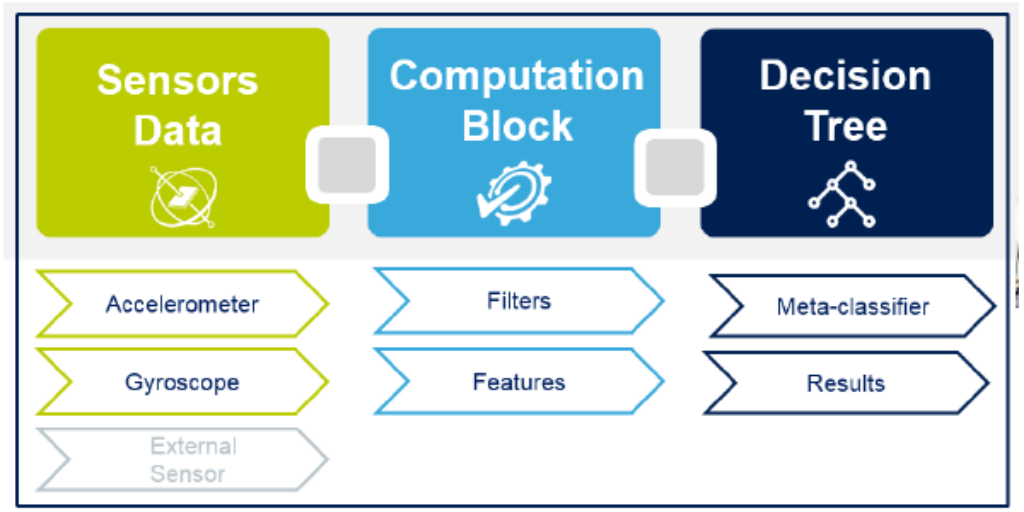
Machine Learning Core Capability

MLC: a unique feature integrated on a IMU

Some examples of algorithms which can be embedded in MLC

- Vibration monitoring
- Activity recognition
- Gym activity recognition
- Motion / Stationary
- 4D / 6D
- Flip-Up / Down
- … and others!





Easy and Effective Application Development

- STM algorithms database available
- High level of customization
- Ultra low power

MLC current consumption: few uA

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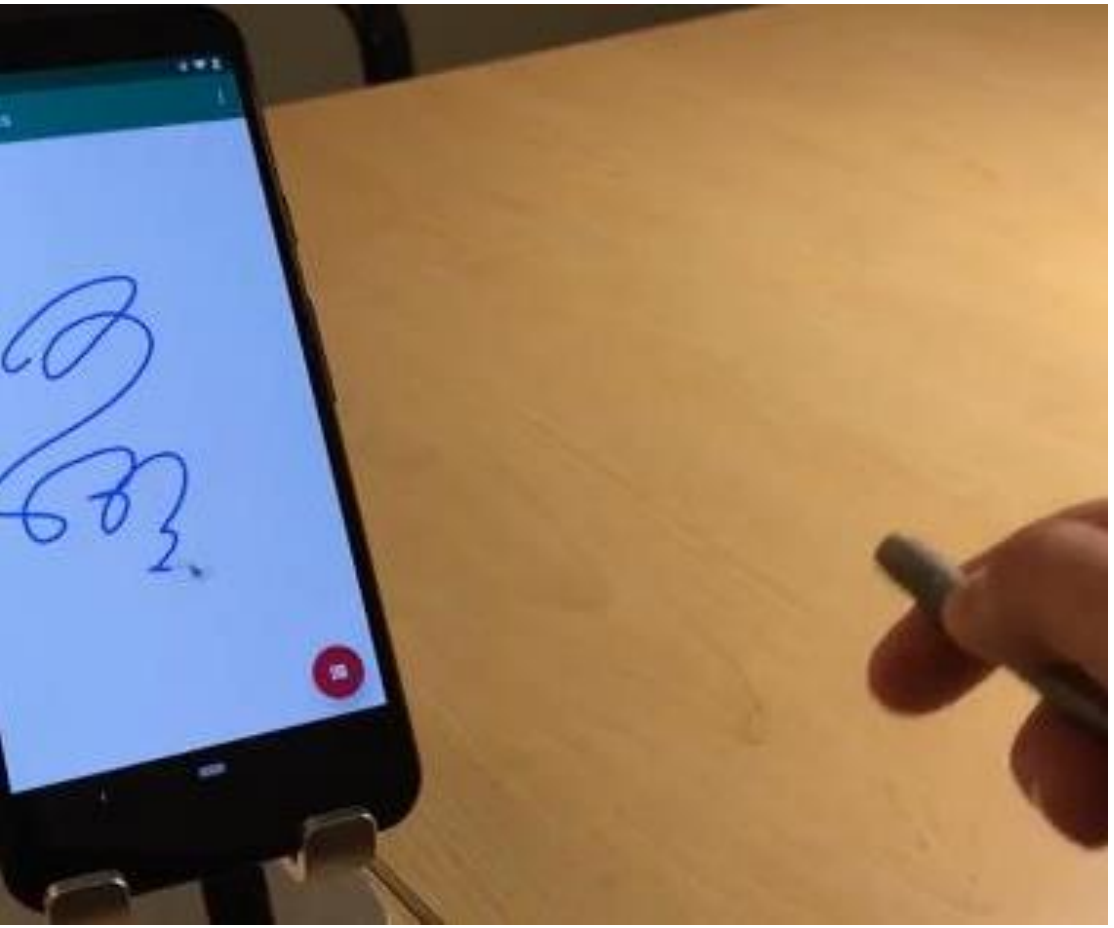
Smart Pen with the LSM6DSO



Sensor Fusion Algorithm and Bluetooth connectivity

High accuracy thanks to the LSM6DSOX IMU

Recognition of different activities with the LSM6DSOX

Wireless SOC BlueNRG-2

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Sensor Fusion Algorithm

and Bluetooth Connectivity

Compute with high accuracy the position and motion of the pen and communicate to the screen

LSM6DSOX
Motion sensors

Accelerometer

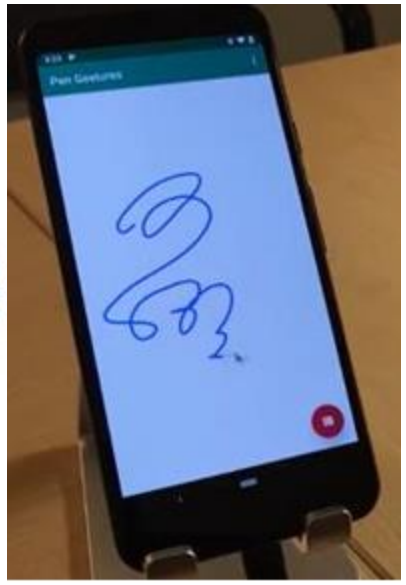
Gyroscope

Bluetooth SoC

Sensor Drivers

SCD Cal Record

MotionEngine™



Average power consumption of 2.9mA with cursor motion

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Accelerometer 70 µg/√Hz

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-15% vs. LSM6DSL/M

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P2P with LSM6DSL, LSM6DS3, LSM6DSO, SW compatible

Recognition of Different Activities
with the LSM6DSO

Leveraging the Machine Learning core capabilities

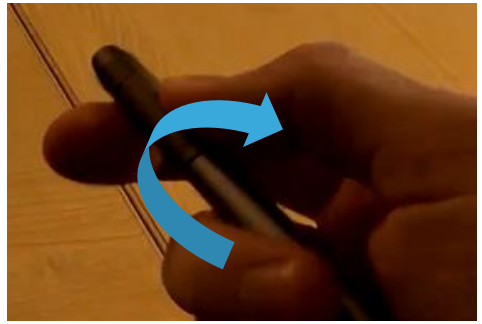
The Hillcrest / CEVA algorithm unleash the capability of the LSM6DSOX:

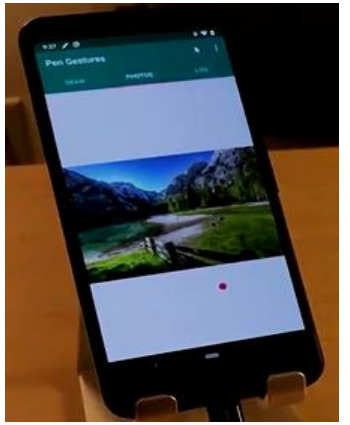
<u>Drawing mode:</u>

- Cursor: position the pen on the screen
- Shake: erase the previous drawing
- Double Circle: trigger the color change

<u>Picture mode:</u>

- Swipe slideshow left and right
- Zoom in/out with rotation motion





<u>Zoom in</u>

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Recognition of Different Activities
with the LSM6DSO

Leveraging the Machine Learning core capabilities

LSM6DSOX Sensor	Sensor Current consumption
Core	15 µA
MLC – not used	0 µA

MCU	Wake-up rate	MCU Current consumption
STM32F401RE	1/16 = 63ms	91 µA
STM32L152RE	1/16 = 63ms	82 µA

LSM6DSOX Sensor	Sensor Current consumption
Core	15 µA
MLC	4 µA

MCU	Wake-up rate	MCU Current consumption
STM32F401RE	1 s	9.27 µA
	30 s	3.02 µA
	100 s	2.8 µA
STM32L152RE	1 s	3.24 µA
	30 s	1.46 µA
	100 s	1.4 µA

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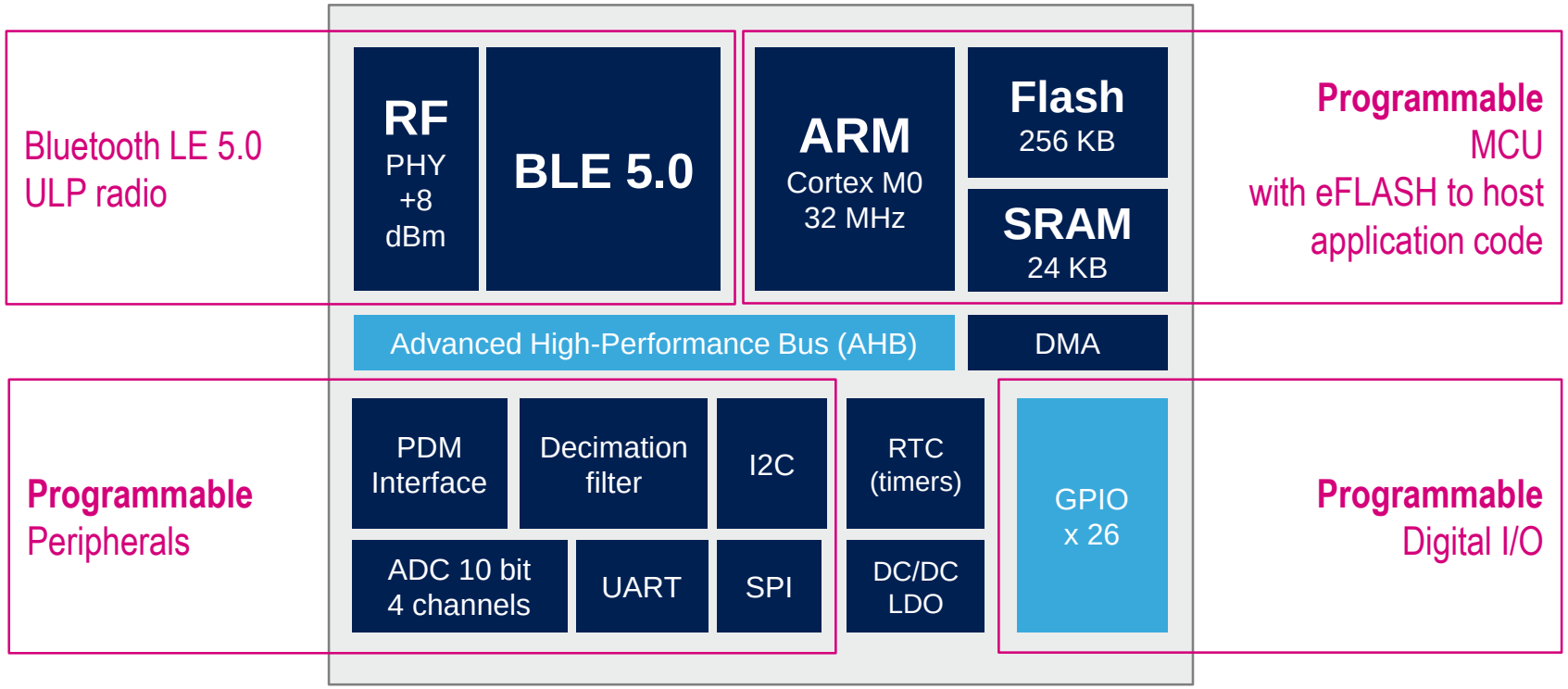
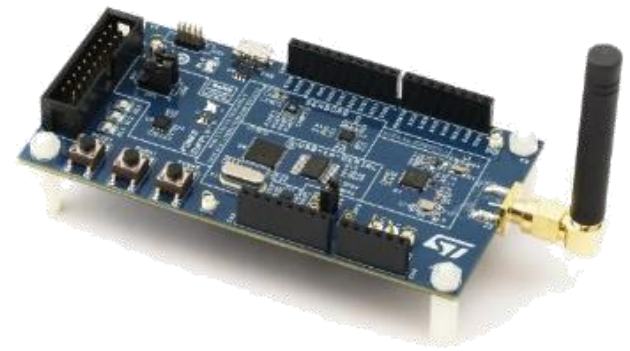
BlueNRG-2 Wireless SoC

Bluetooth LE programmable processor





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BlueNRG-2 Wireless SoC

Bluetooth LE programmable processor

KEY FEATURES

New enhanced features

- Bluetooth 5.0 certification
- Up to 256 Kbytes of embedded Flash memory
- State-of-the-art security and privacy features
- Faster data transfer rate with packet length extension
- Enhanced power saving with sub-µA sleep mode
- Operating temperature up to +105 °C
- Up to +8 dBm maximum output power
- Up to 26 GPIOs (in QFN48 package)
- Triple package offering:
  - QFN32 (5 x 5 x 1 mm)
  - WLCSP32 (2.66 x 2.56 x 0.5 mm)
  - QFN48 (6 x 6 x 1 mm)

KEY BENEFITS

Extended battery life and secure connection

- Optimized memory architecture: 256 Kbytes of Flash memory, 24 Kbytes of ultra-low-leakage RAM (with full data retention)
- Single-core, ultra-low-power 32-bit ARM® Cortex®-M0 core architecture up to 32 MHz

KEY APPLICATIONS

- Smart Things
- Smart Home
- Industrial
- Gaming and Toys
- Healthcare and Fitness
- Finder/Tags and Tracking

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360° Lid Angle Detection

Robust in unstable conditions

High accuracy thanks to the LSM6DSOX IMU

Machine Learning Cores and Finite State Machines

Low power solution for portable devices

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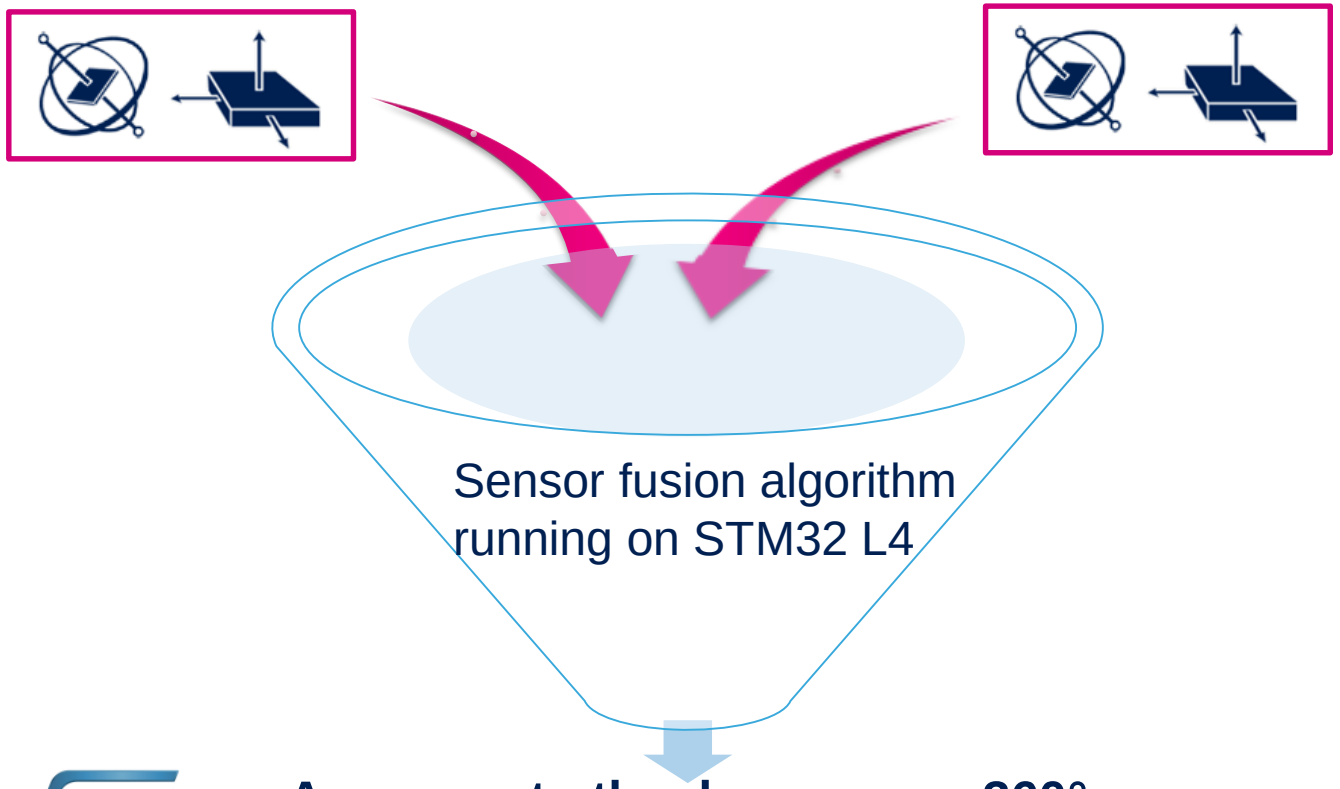
Robust in Unstable Conditions

Unique solution of 2 IMUs for accurate angle measurement

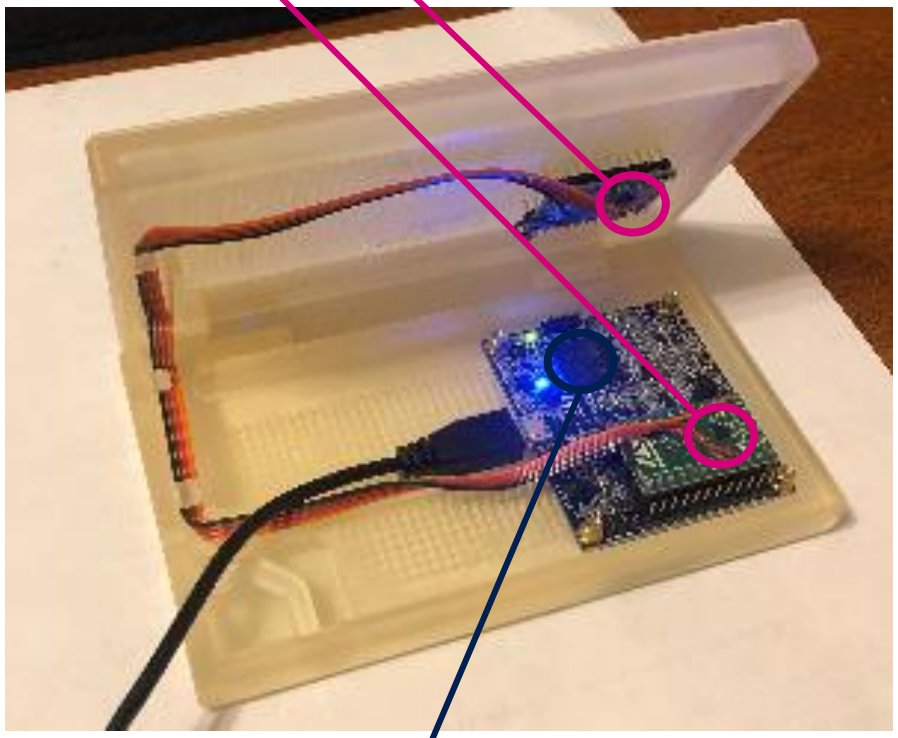
LSM6DSOX #1

LSM6DSOX #2



Accuracy to the degree over 360°

In every conditions & orientations



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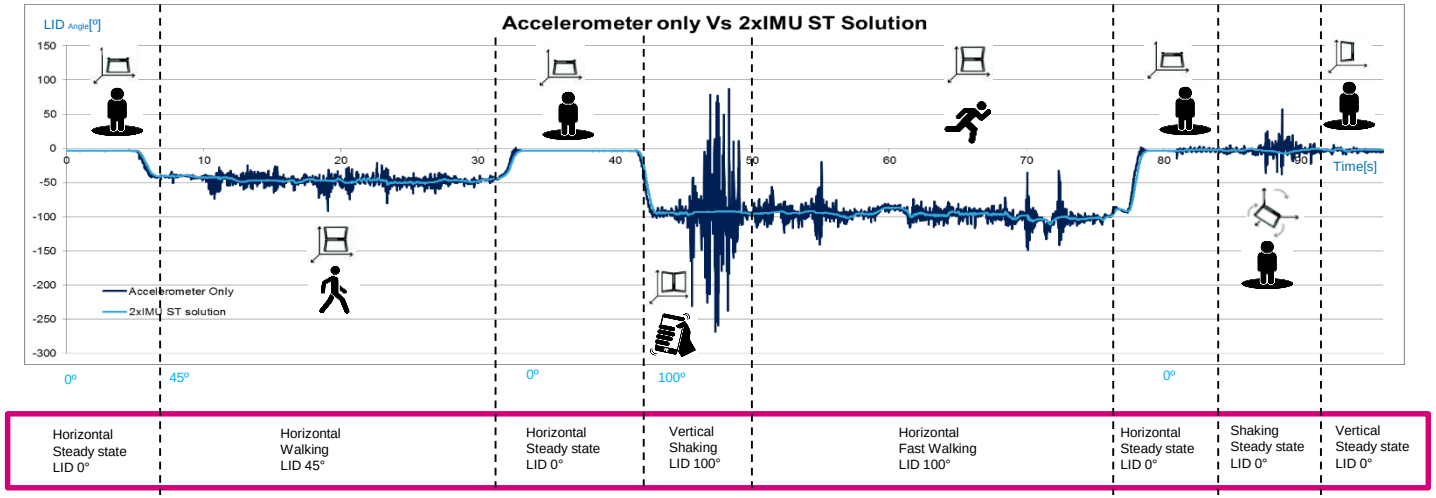
Robust in Unstable Conditions

Unique solution of 2 IMUs for accurate angle measurement

- Enhanced LID angle computation
  - Works for any device orientation (“Book orientation”)
  - ODR independent & High bandwidth
  - No dependency on the magnetic environment
  - Linear acceleration rejection block

- Demo kit composed of
  - ProfiMEMS board
  - 2x LSM6DSO/OX IMU
    - Also compatible with LSM6DSR
  - MS-Windows Application



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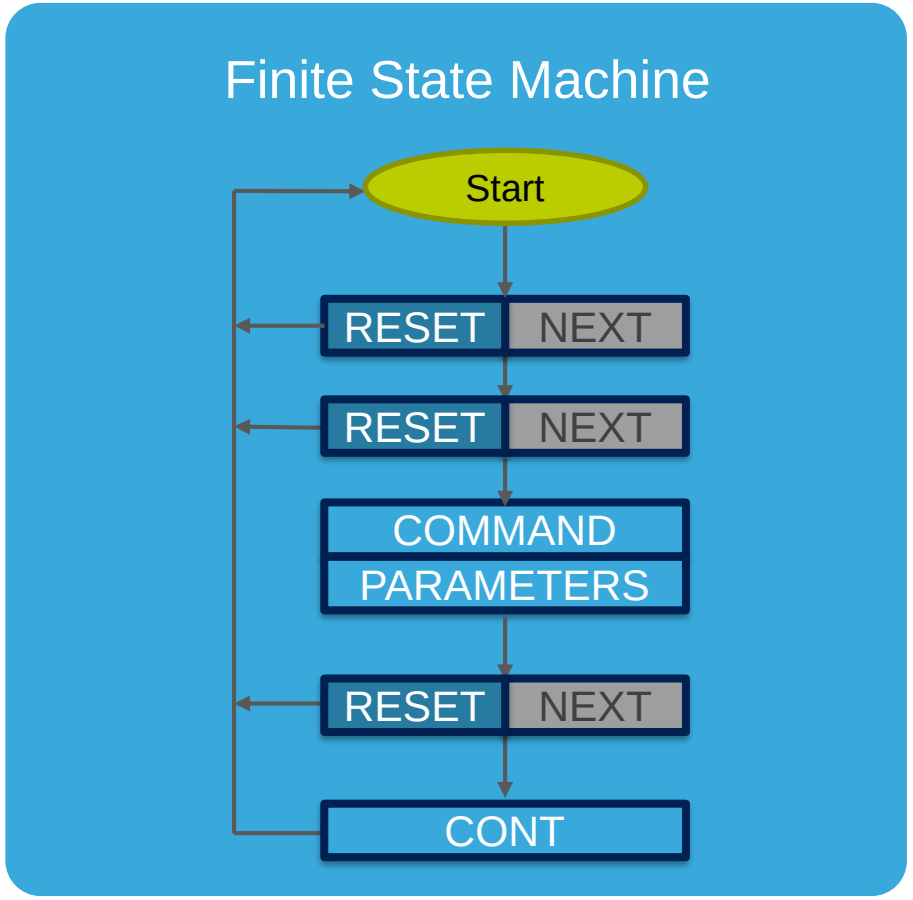

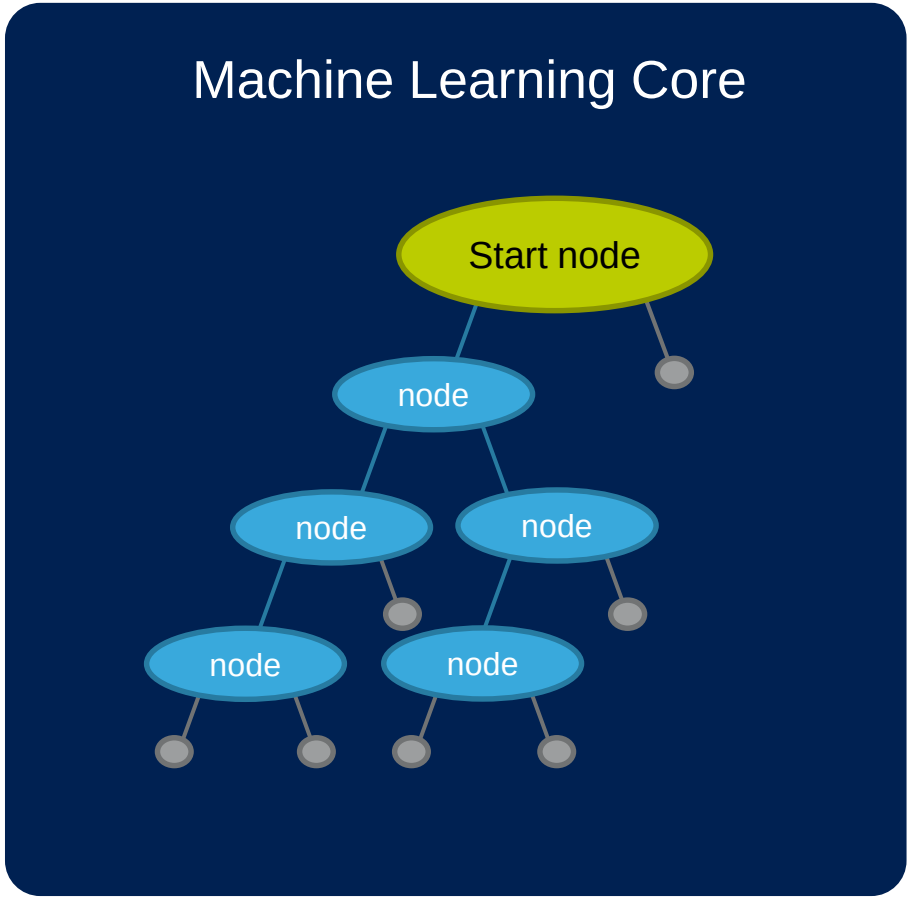

FSM and MLC allows sensors to process data with reduced help of a host Microcontroller

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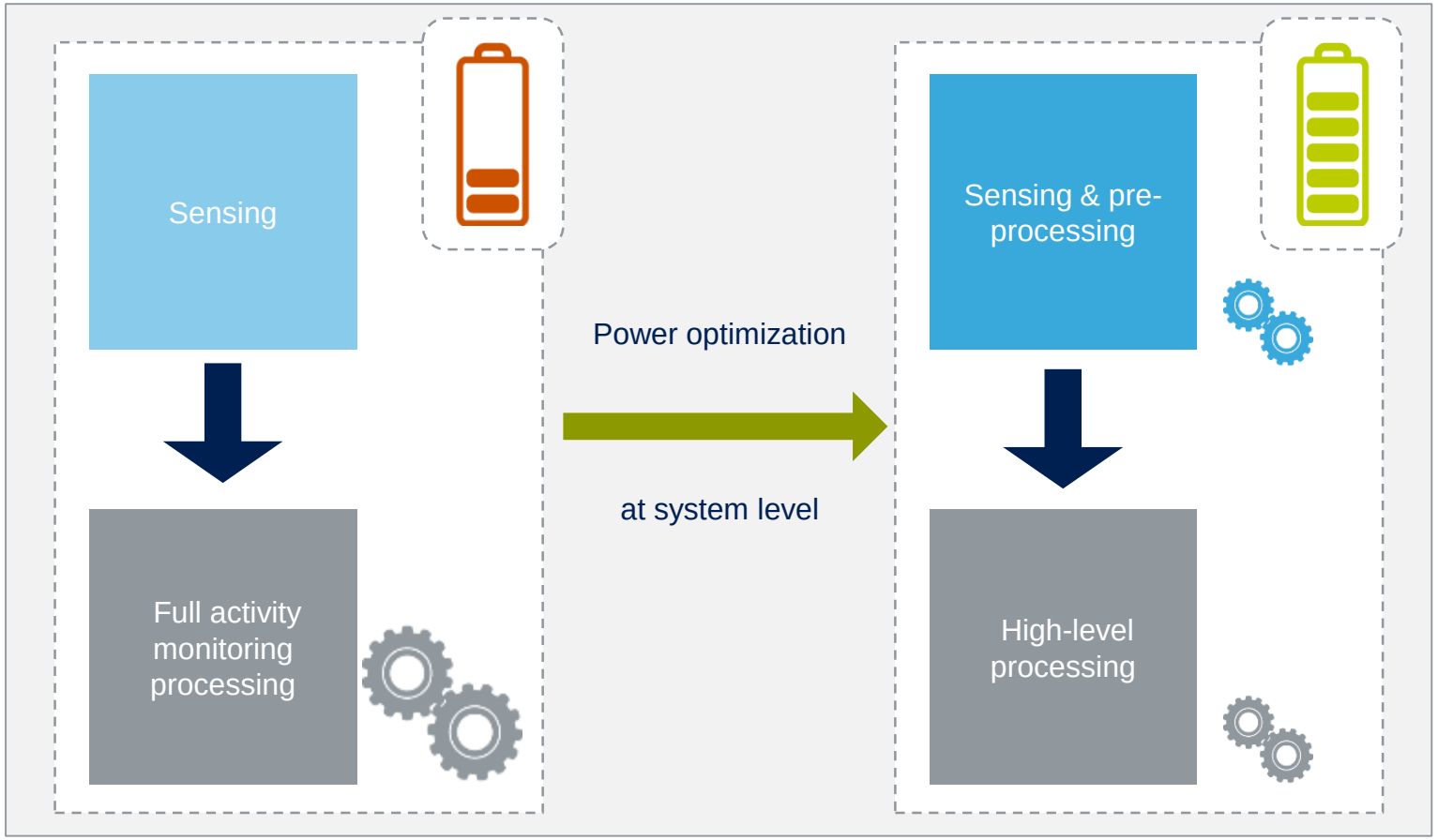
Low Power Solution
for Portable Devices

Bring the computing power back to the edge



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