CEVA TECHNOLOGY SYMPOSIUM SERIES

Sub 2$ single SoC GNSS embedded with NB-IoT for 10-year device operation

José María López-Almansa

gmv INNOVATING SOLUTIONS

GMV, WHO WE ARE

GMV ACTIVITIES ON GNSS

SDR FOR IoT: srx-iot

WHO WE ARE

A GLOBAL TECHNOLOGY GROUP

Multinational technology group

Headquarters in Spain (Madrid)

1,800 employees

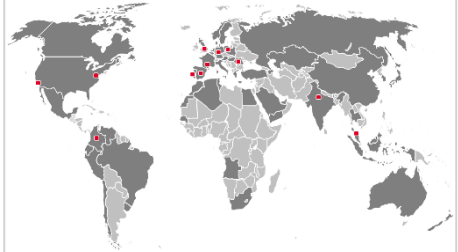
Roots tied to Space

CMMI level 5

CMMIDEV/5 SM
Exp. 2016-09-16 / Appraisal #20109

Private capital

Subsidiaries in 11 countries



Founded in **1984**

175M€ worldwide revenue

Aeronautics, Space, Defense, Security, Transportation, Healthcare, Banking & finances, and ICT industries

Space	Defense	IT	Transport
50%	10%	20%	20%

GMV ACTIVITIES ON GNSS

GMV IN GNSS

- Key player in european GNSS activities over the last 25 years.
- Team of about 200 GNSS engineers.
- Core GNSS activities:
  - Galileo system design
  - Development of critical software elements for Galileo
  - Precise Orbit Determination
  - GNSS User & Integrity algorithms
  - GNSS receiver development
- September 2018:
  - ***GMV wins 250 million euro ground control contract for Galileo navigation system***

https://spacenews.com/gmv-wins-250-million-euro-ground-control-contract-for-europes-galileo-navigation-system/

GNSS RECEIVER ACTIVITIES IN GMV

- Activities started in 2007.

- Main product lines:

srx: Software-Defined GNSS receiver family:

- Automotive
- Space (onboard receiver for satellites, ongoing project for European Space Agency)
- GPS, Galileo, Glonass, Beidou, EGNOS

presence: Hardware (FPGA-based) GPS+Galileo Receiver:

- PRS (Public Regulated Service): Encrypted signal, only for authorized users (Police, Military…).
- GMV: only provider for Galileo PRS receivers in Spain and one of five in Europe

srx-10: SDR GNSS low-cost receiver

Software: -Whole processing performed on a host processor (from digital samples to final position)

-No additional hardware required (only RF Frontend)

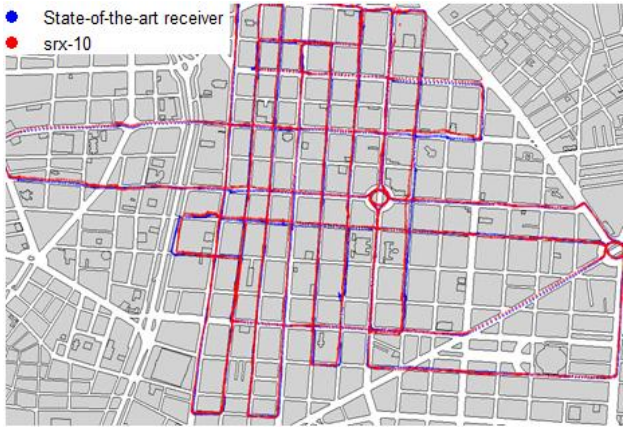
GNSS: -Multiconstellation, covering the following systems:

GPS, GLONASS, Galileo, Beidou (and EGNOS)

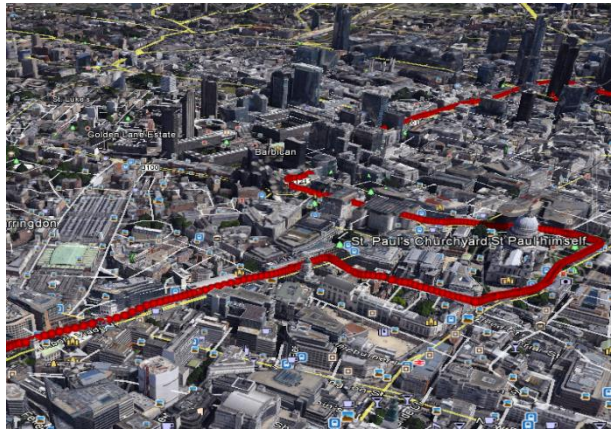
Low cost: -Optimized (algorithmically and computationally) to run on low-end processors

srx-10: Examples of urban performance

Madrid City Center



London City Center



- Urban scenarios are very challenging, due to continuous loss and recovery of satellites (blocked by buildings)
- *srx-10* implements fast reacquisition techniques to maximize satellite availability
- GPS and GLONASS versions validated on exhaustive campaigns in Madrid and London

SDR FOR IoT

srx-iot

GNSS FOR IoT

Many IoT applications benefit from GNSS positioning

- Trackers for people, pet, bikes, cars, asset, smart meters…
- Position needed on demand or periodically but not continuously for navigation
- Most of the time GNSS is in sleep mode
- Minimum power for long battery life

Conventional approach for IoT GNSS

- Dedicated GNSS hardware receiver within the IoT device
- No A-GPS support (cellular network assistance to reduce power)
- Drawback: idle most of the time → inefficient use of silicon

Software-Defined GNSS for IoT

Whole GNSS signal processing implemented in software within a DSP

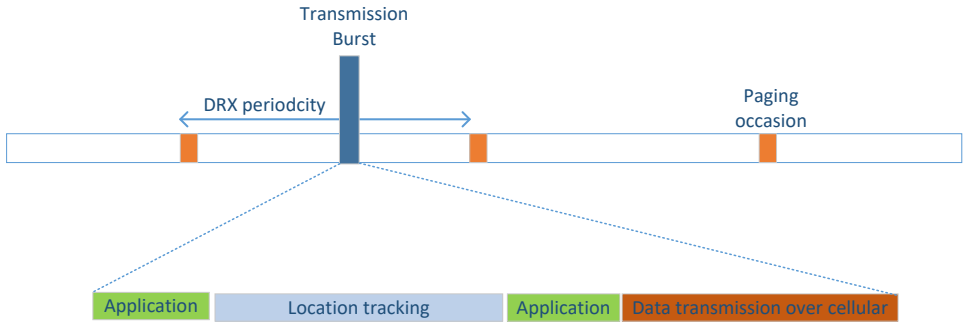
- From digital I/Q samples to final positioning

The IoT device *becomes a* GNSS receiver only when required

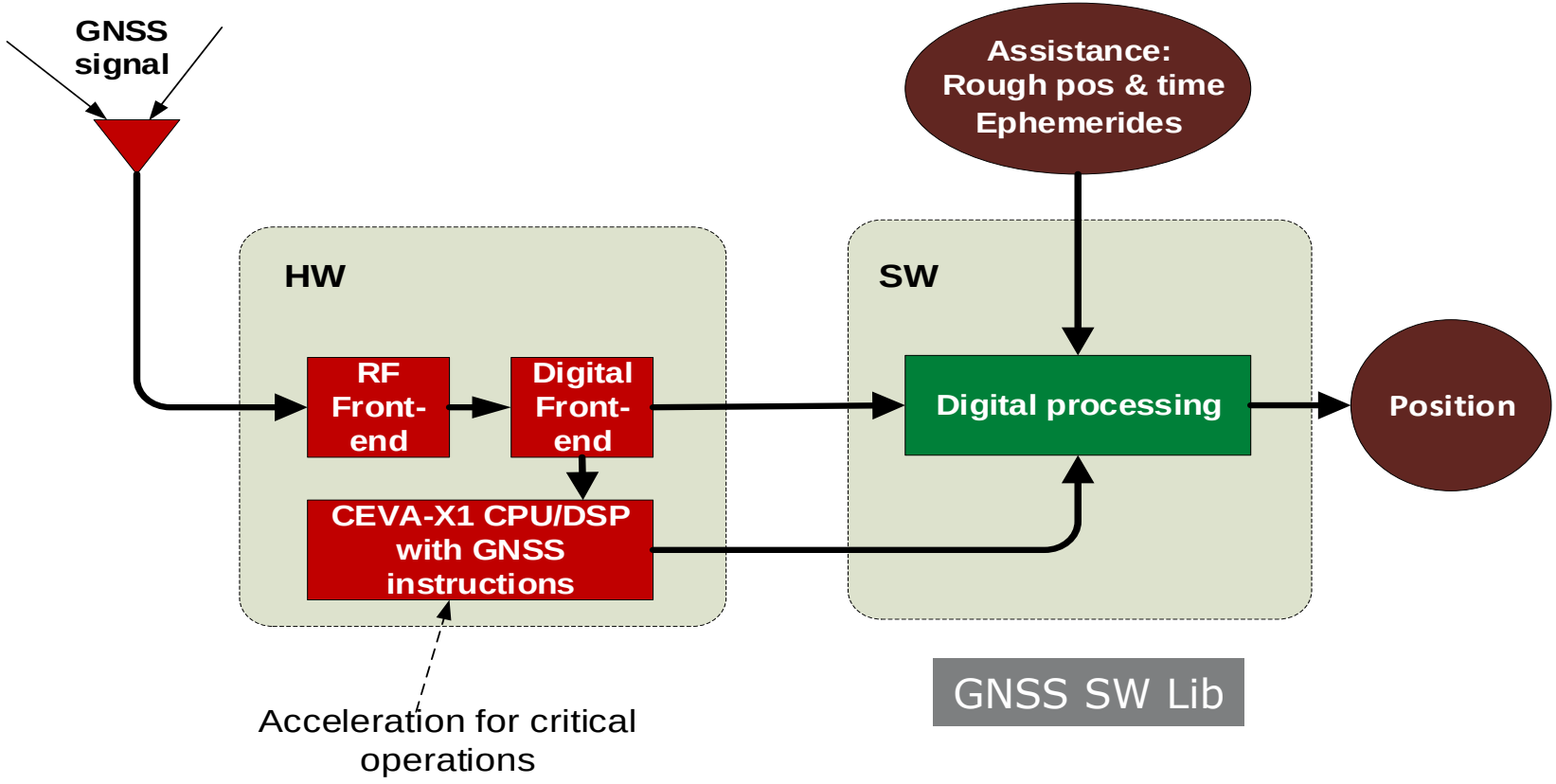
- Minimum GNSS dedicated hardware
- When finished, GNSS goes to sleep
- Processing resources (RAM, MIPS) can be shared between NB-IoT and GNSS

CEVA-GMV PARTNERSHIP FOR GNSS IoT

- CEVA and GMV partnered to develop a Soft GNSS solution for IoT on CEVA-Dragonfly NB2 platform
- Drivers and assumptions
  - All SW tasks are time multiplexed
    - Application, GNSS and NB-IoT tasks run in sequence on CEVA-X1 CPU/DSP
    - GNSS performs a position fix, on demand or periodically and goes to sleep
    - Then CEVA-X1 is available for NB-IOT and sensor fusion
  - Short time to fix, to minimize power and extend battery life
  - Assistance from network
    - Rough position and time
    - Ephemerides
  - No need for dedicated MIPS and RAM
    - Reuse NB-IoT MIPS and RAM footprint
    - Ensures lowest combined NB-IoT & GNSS cost



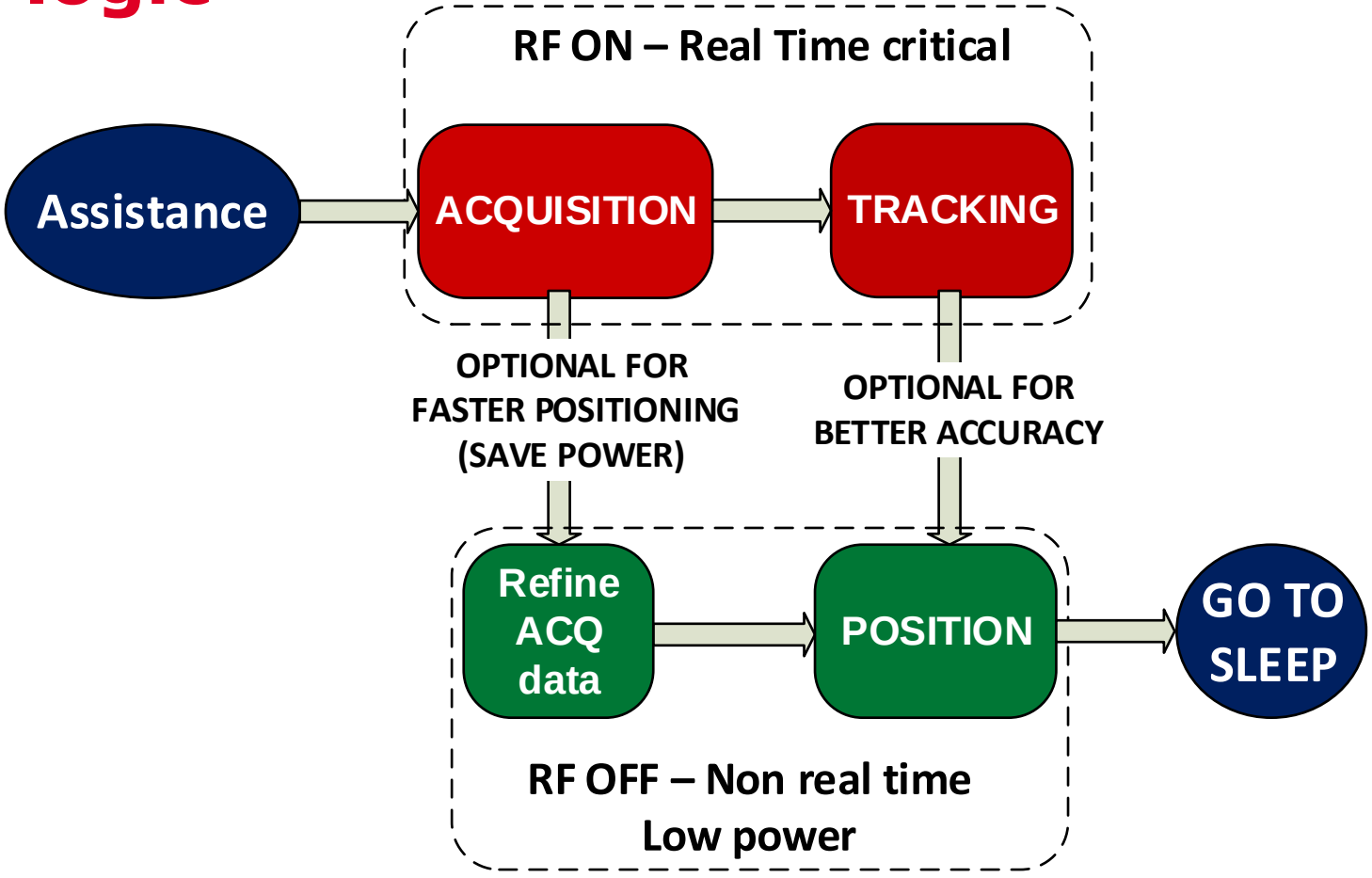
GNSS *srx-iot* ON CEVA-Dragonfly NB2



srx-iot in DragonFly NB2

- Low cost
  - Dual mode RF transceiver NB-IoT and GNSS
  - Flexible GNSS Digital front end HW to filter and resample digital signal before DSP SW processing
  - Single CPU/DSP core solution for NB-IoT and GNSS
- Low power
  - Efficient and unique GNSS algorithmic solution for Network Assisted GNSS
  - Reduction of "RF-on" times, resources sharing with NB-IoT modem
- Flexibility
  - Easy to support IoT Use-case specific GNSS working modes
  - Support of multiple GNSS constellations
  - Easy scheduling of additional processing on the same platform: sensor fusion, voice cmds, ….
- Upgradable solution
  - Firmware upgradable OTA (Over The Air)
  - Enables performance tuning during product lifecycle

srx-iot logic



srx-iot MULTI-CONSTELLATION ROADMAP

- Constellation support
  - GPS 1Q19
    - Now fully ported and optimized, on-going lab testing and validation
  - Beidou 2Q19
  - Galileo 2H19

- SDR approach provides strong flexibility for multi-constellation
  - Number of channels (satellites) for each system
  - Initial acquisition with best constellation for application and final processing with multi-constellation
  - Full or half signal processing depends on use-case power/accuracy budget

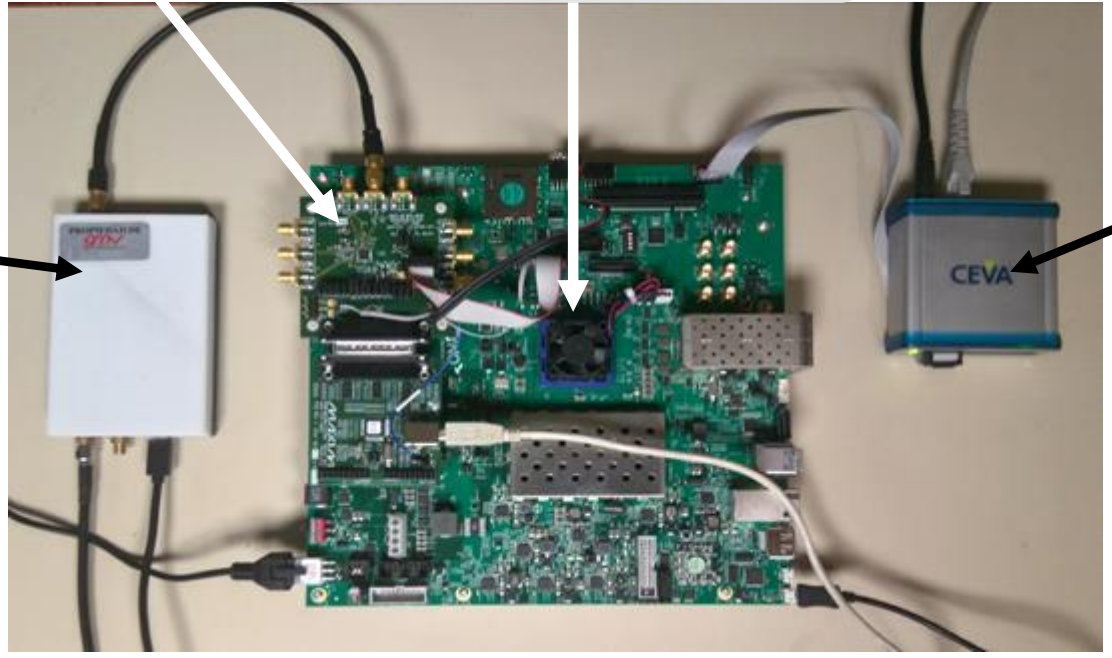
srx-iot DEVELOPMENT & DEMO PLATFORM

RF front-end

FPGA synthesizing DragonFly+*srx-iot*

RF transmitter

(GPS signal stored in PC)



J-BOX interface

(to PC)

srx-iot DEMO GRAPHICAL TOOL

www.gmv.com

THANK YOU

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gmv BLOG