

Cloud-based Snapshot GNSS solution

ESA-NAVISP2-AlboraCGNSS

March 2022

Agenda

Albora Technologies Limited

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- **Company background**
- Project background and objectives
- Product performance
- Test campaign results
- Conclusions

Company background

Albora Technologies Limited

Albora



Founded in **2017** by Anselm Adams in the United Kingdom with offices in London (HQ) and Barcelona.

Our **vision** is to deliver high-accuracy geolocation to everyone, everywhere.

Our **mission** is to software geolocation technology to make it available to the mass-market.

<https://albora.io>

Team



16 FTEs (4 PhDs) experts in distributed computing and GNSS fields.

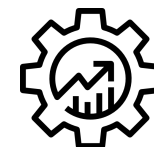
Board members:

- Steve Cliffe 
- David Clayton  

Senior advisors:

- Rafel Fors 
- Joan Taulé   

Traction



Partners:

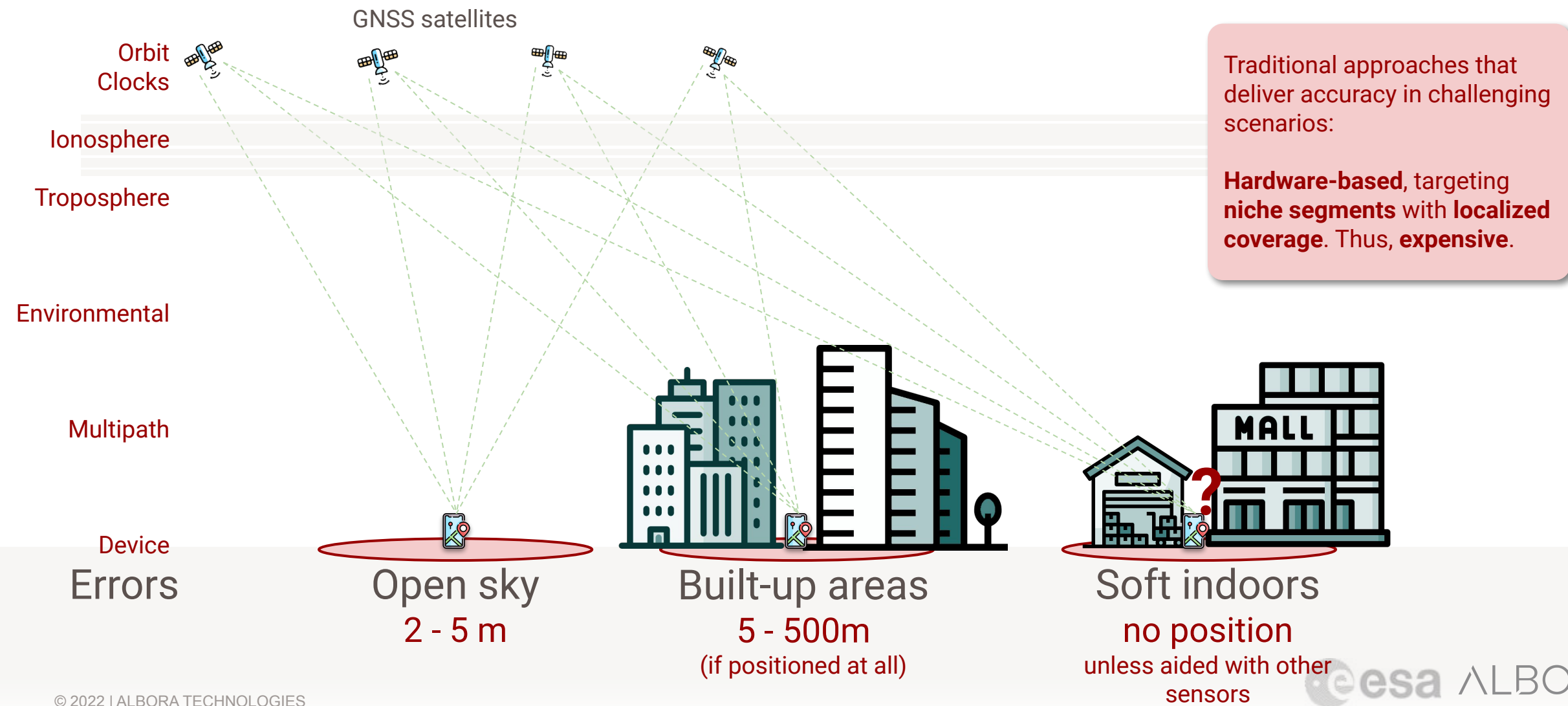


Grants, acceleration and awards:



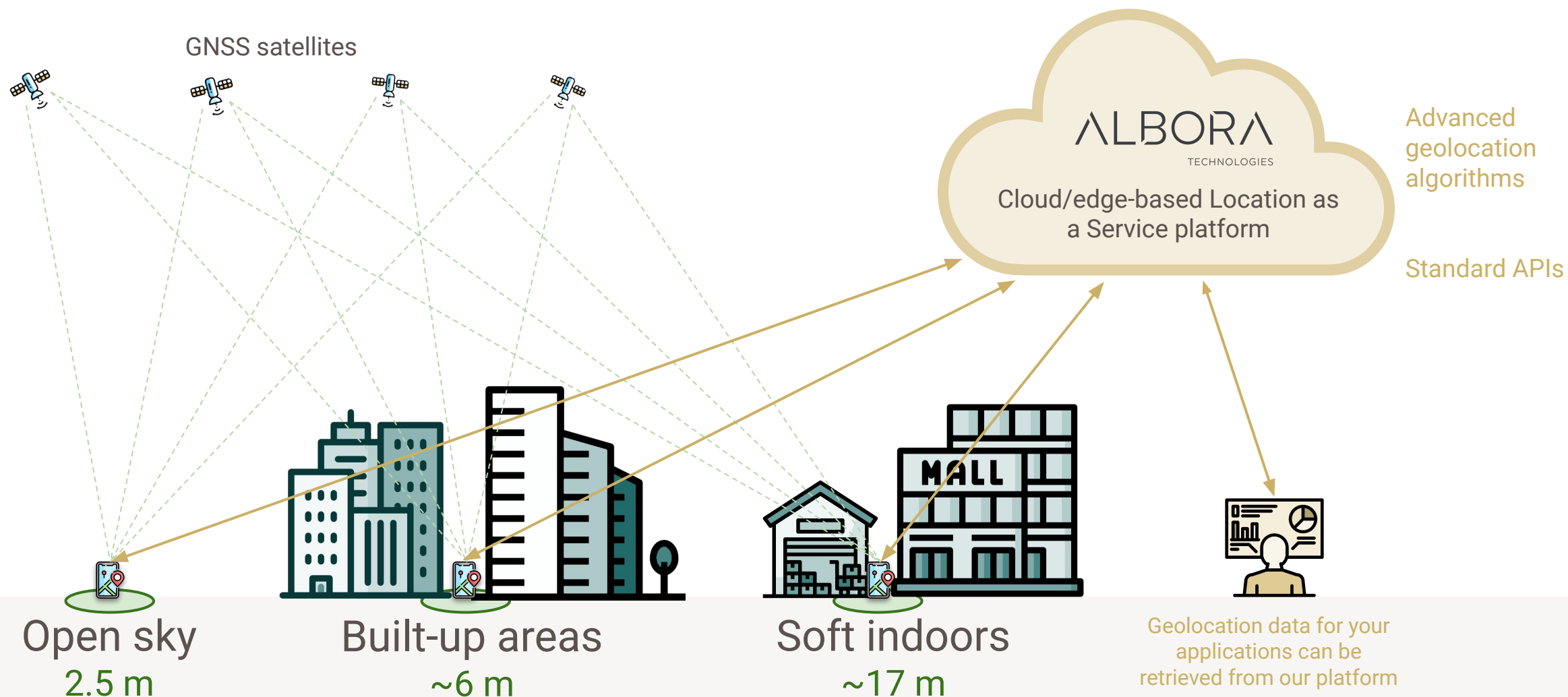
Current GNSS positioning challenges

affected by errors at different levels



Albora high-sensitivity solution

enables high-sensitivity positioning for challenging environments



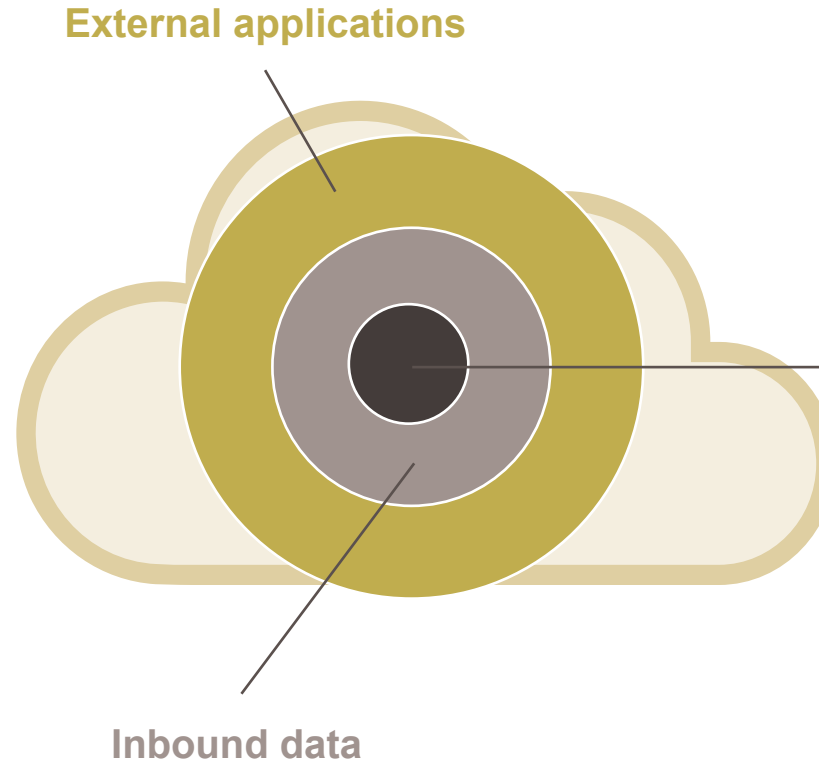
Albora's cloud/edge platform

Scalable, ubiquitous, interoperable and extensible

Albora's approach

- Software-based
- Ubiquitous
- User-friendly (HW-agnostic + Plug & Play service)
- Affordable SaaS model

Ideal approach for the mass-market



Algorithms

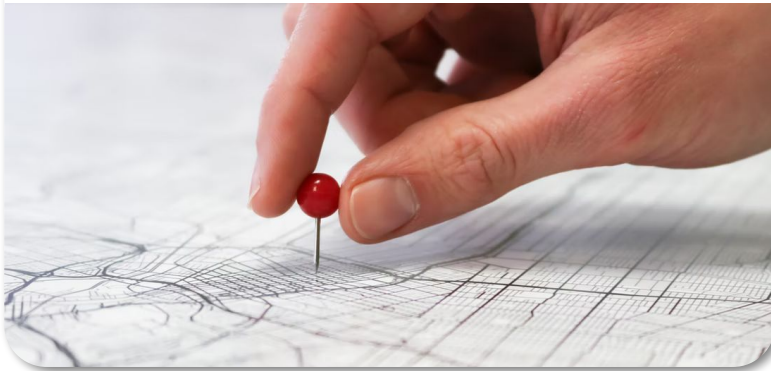
- Anti-jamming
- Anti-spoofing
- Analytics
- High-accuracy
- **High-sensitivity**

Relevant use cases for high-sensitivity location services

Improved geolocation data to widen location-based services value proposition

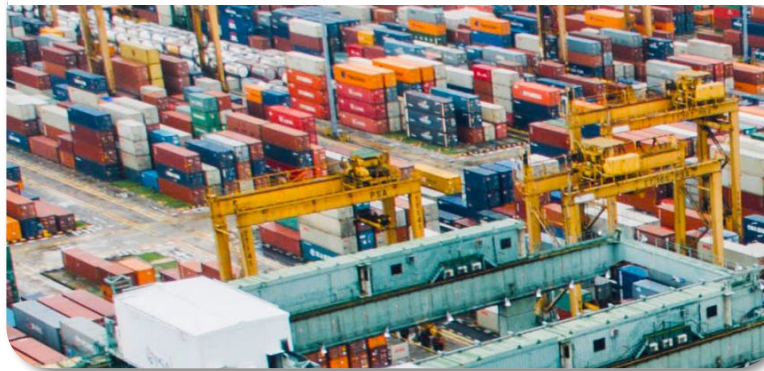
Accurate user's location

- Emergency/Panic button.
- Locate and rescue support.
- First responders.



Critical infrastructure

- Location of sensitive assets in challenging scenarios.
- Regulation compliance.
- Safety.



Industry 4.0

- Soft-indoor geolocation.
- Geo-fencing
- Logistics support.



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Project background and objectives

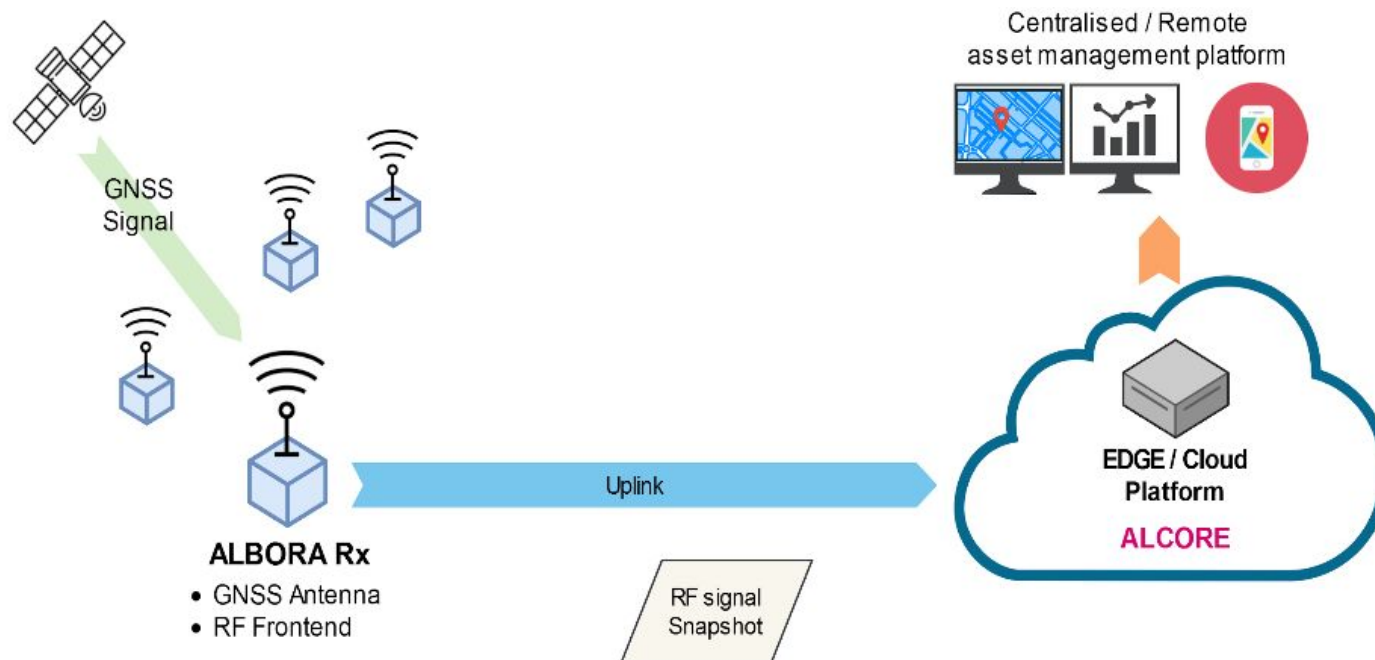
Background

AlbaSnap

The product is a **cloud-based snapshot GNSS solution** that provides augmented signal sensitivity and antijamming capabilities.

Key Features of **Alcore** technology:

- Direct Position Estimation (DPE) enabled receiver for enhanced sensitivity.
- Robust Interference Mitigation (RIM) for resiliency under jamming interferences.
- Cloud-based, software-centric architecture.



Project background and objectives

Development objectives

High sensitivity and robust GNSS snapshot processing

- Improve L1/G1 operation
- Add L5 band support
- Implement Direct Position Estimation (DPE) based integrity algorithm
- Incorporate anti jamming techniques based on Robust Interference Mitigation (RIM)

Reliable and scalable edge and cloud-based software solution:

- Handle a large number of receivers
- Reduce memory footprint and CPU-time
- Asset registration and identification
- Multi-tenancy, authentication and authorization support

Test campaign and validation consolidation:

- Validating the end-to-end technology in relevant environments.
- Benchmarking against COTS

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Product performance

Evolution

Heritage product

Snapshot	100 ms
Bands	L1/G1
Signals	Galileo E1C, GPS L1CA, BeiDou B1C, Glonass L1OF
Horizontal accuracy	3 m CEP
Velocity accuracy	✗
Sensitivity	29 dB-Hz
Time-to-first-fix	40 second
DPE integrity	✗
Antijamming	✗

Product at the end of the activity

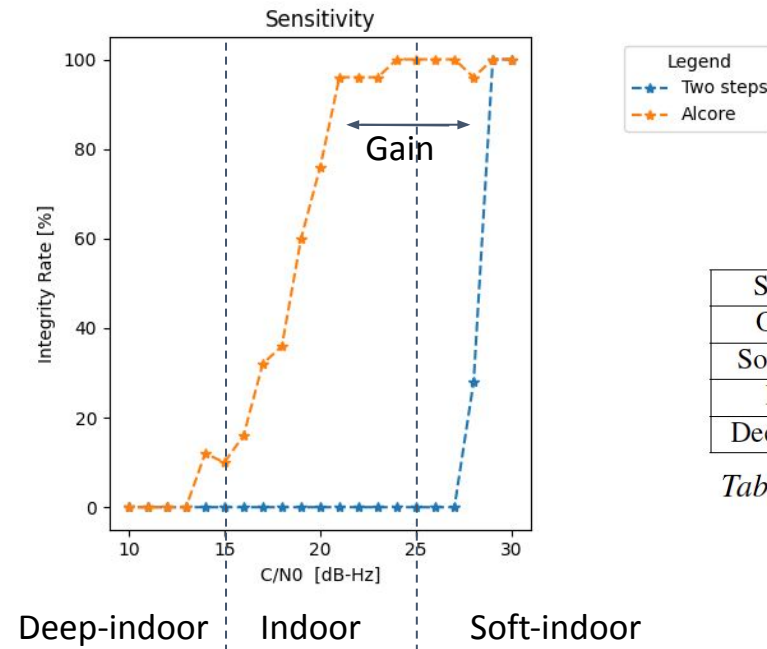
Snapshot	100 ms	
Bands	L1/G1	L5
Signals	Galileo E1C, GPS L1CA, BeiDou B1C, Glonass L1OF	Galileo E5a, GPS L5, BeiDou B2a
Horizontal accuracy	2.5 m CEP	1.7 m CEP
Velocity accuracy	0.3 m RMSE	0.3 m RMSE
Sensitivity	21 dB-Hz	21 dB-Hz
Time-to-first-fix	10 seconds	15 seconds
DPE integrity	✓	✓
Antijamming	✓	✓

Product performance

Sensitivity analysis

Sensitivity

- Computed using a GNSS signal simulator
- Simulated open-sky scenario with CN0s ranging from 10 dB-Hz to 30 dB-Hz
- DPE shows a gain of **8-9 dB-Hz** with respect to two-steps



Scenario	Attenuation [dB]	Received C/N ₀ [dB-Hz]
Outdoor	≤ 10	≥ 35
Soft-indoor	10 – 20	25 – 35
Indoor	20 – 35	10 – 25
Deep-indoor	≥ 35	≤ 10

Table 1: Classification of GNSS working environments.

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Test campaign results

Anti-jamming

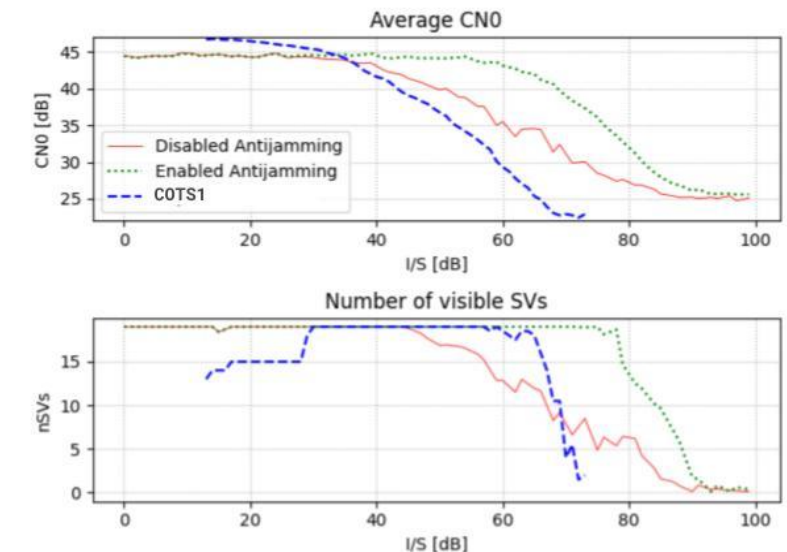
Anti-jamming results

- Computed with RFI and GNSS signal simulator
- Three different scenarios considered
 - Single-Tone continuous wave
 - Swept narrowband CW
 - Swept wideband CW
- The RIM anti-jamming technique is able to mitigate the effect of jamming with high I/S ratio values
- Benchmarking against a commercial off-the-shelf receiver (COTS1)

Benchmarking results

Anti-jamming	Disabled	Enabled
Single-Tone CW	+3 dB	+20 dB
Swept Narrowband CW	+10 dB	+20 dB
Swept Wideband CW	+5 dB	+20 dB

Swept narrowband case



Test campaign results

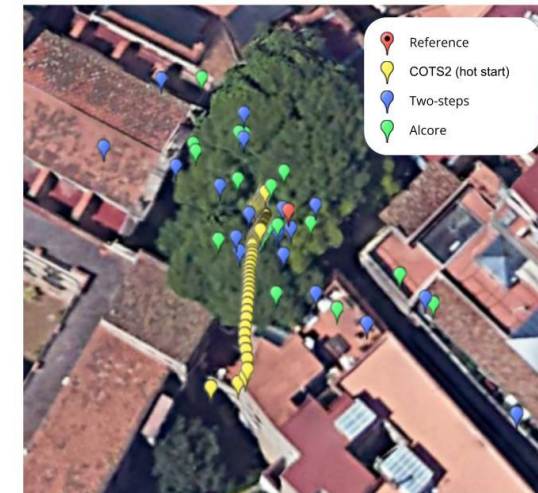
Challenging scenarios

Test campaign

- Complex environment scenarios
 - Multi-path rich urban canyon
 - Industrial area
 - Mild indoor
- Dynamic vehicular test
- Benchmarking: 2 COTS receivers
- Ground truth: Obtained with an RTK receiver with dead reckoning

Urban canyon case

Receiver	AlbaSnap (Alcore)	COTS2		COTS3	
Configuration	L1-G1/100ms	Cold Start	Hot Start	Cold Start	Hot Start
TTFF [s]	10	N/A	31	N/A	N/A
RMSE Horiz. Position [m]	8.60	N/A	6.44	N/A	N/A
CEP [m]	6.70	N/A	3.27	N/A	N/A

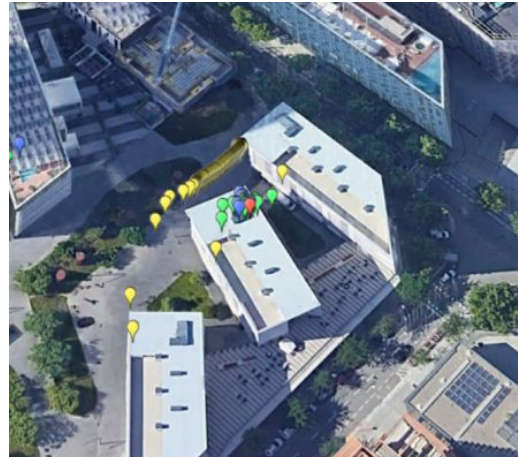


Test campaign results

Challenging scenarios

Industrial area

Receiver	AlbaSnap (Alcore)	COTS2		COTS3	
Configuration	L5/100ms	Cold Start	Hot Start	Cold Start	Hot Start
TTFF [s]	15	39	19	N/A	N/A
RMSE Horiz. Position [m]	6.98	19.93	16.44	N/A	N/A
CEP [m]	5.64	20.17	15.57	N/A	N/A



Test campaign results

Challenging scenarios

Soft indoor scenario

Receiver	AlbaSnap (Alcore)	COTS2		COTS3	
Configuration	L5/100ms	Cold Start	Hot Start	Cold Start	Hot Start
TTFF [s]	15	N/A	14	N/A	N/A
RMSE Horiz. Position [m]	24.69	N/A	34.31	N/A	N/A
CEP [m]	17.26	N/A	33.95	N/A	N/A



Dynamic vehicular test

- Speed up to 71.352 km/h

Band	Velocity RMSE [m/s]
L1/G1	0.989
L5	0.254



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Conclusions

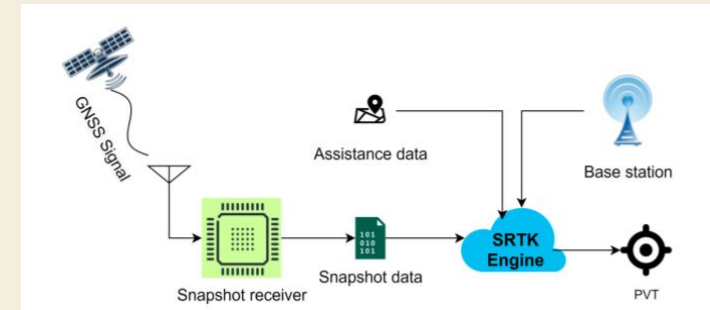
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Conclusion

- Development objectives achieved
 - Improved L1/G1 band performance
 - L5 band support
 - DPE algorithm with integrity increases sensitivity
 - RIM algorithm increases robustness to jammers
 - Asset and user management support
- Test campaign
 - Performance benchmarked in challenging scenarios

Future work

- Snapshot RTK
 - Bringing high accuracy to snapshot positioning
 - RTK fix feasible with snapshots shorter than 40 ms
 - Aiming low-power low-cost devices



<https://www.gpsworld.com/research-roundup-advanced-high-precision-gnss/>



Contact Us

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