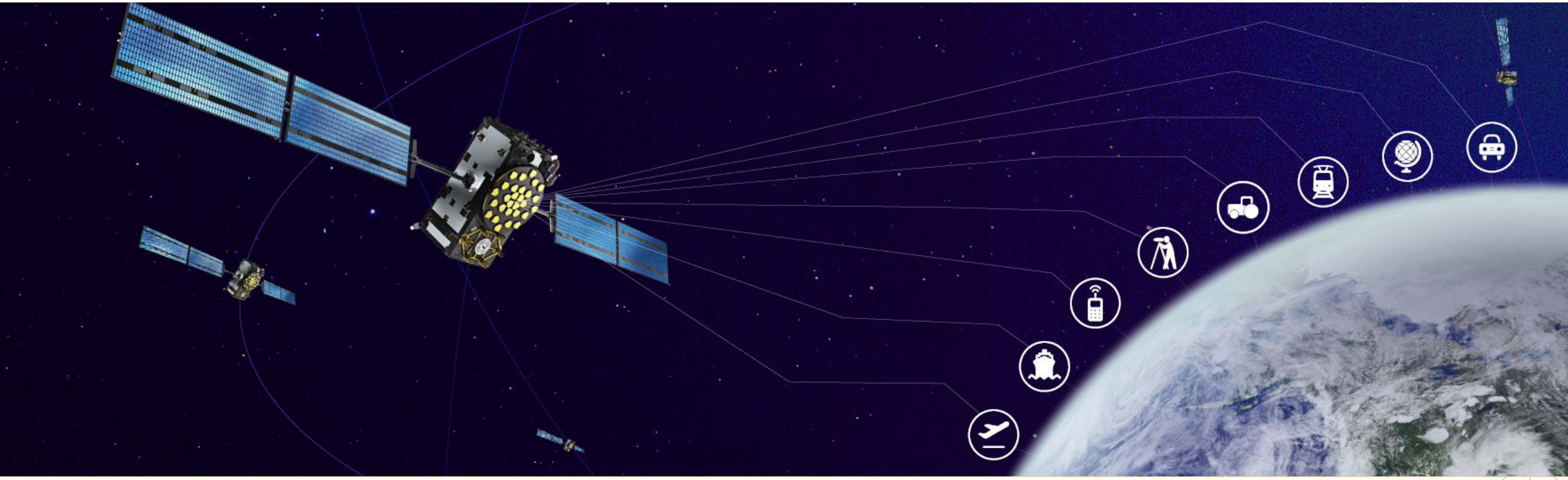


15 Years of EU Satellite Navigation

GSA

GALILEO EGNOS

NAVIGATION MADE IN EUROPE

Autonomous Driving powered by Galileo

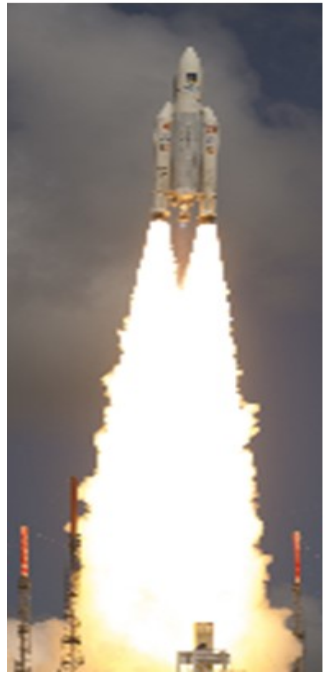
ProPART Final Demo (Boras, Sweden)

Flavio SBARDELLATI, European GNSS Agency

21 November 2019

Galileo is enabled in the majority of cars and consumer platforms

- **26 Satellites launched in 7 years!** : 22 are fully operational
- **12 additional satellites** under manufacturing
- **Galileo is operational since 3 years** (Dec. 15, 2016)



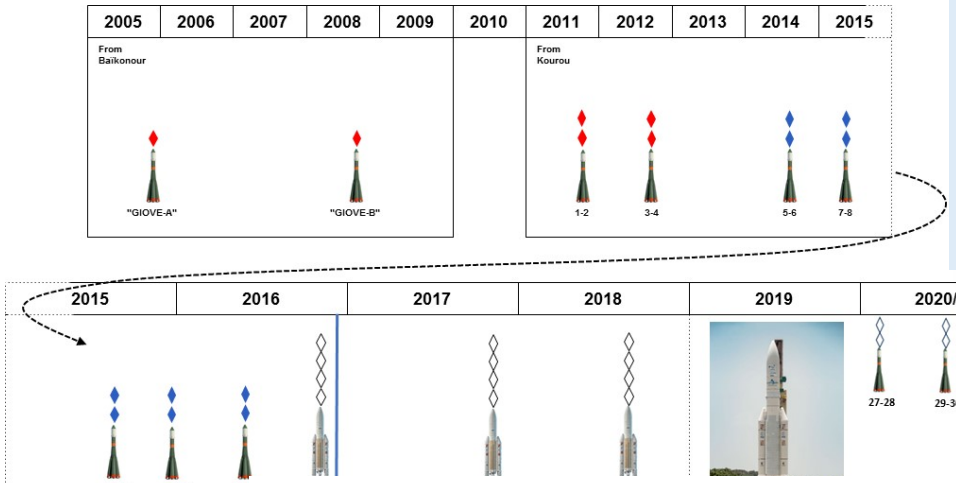
+1,000 Mill. Galileo devices as of today

BlackBerry, SAMSUNG, HUAWEI, MEIZU, lenovo, SONY, bq, vernee, NOKIA, LG, Wiko, mi

USEGALILEO.EU
FIND A GALILEO-ENABLED DEVICE TO USE TODAY

VOLVO, HONDA, ŠKODA, Mercedes-Benz, BMW, Opel, PORSCHE, TESLA, Renault, Ford, Ferrari, KIA, Volkswagen, HYUNDAI, mazda, SSANGYONG, e.GO, STREETSCOOTER, LAND ROVER, LEXUS, Audi, PEUGEOT, SEAT, TOYOTA

Galileo services and roadmap



26 satellites already launched
- 22 operational for NAV
- +1 operational for SAR
- +2 under test
- +1 Spare

Batch	Launch	Satellite	Status	Name
IOV	L1 (21/10/2011)	GSAT 101	Nominal	Thijs
		GSAT 102	Nominal	Natalia
	L2 (12/10/2012)	GSAT 103	Nominal	David
		GSAT 104	SAR only	Sif
FOC	L3 (22/08/2014)	GSAT 201	Elliptic Orbit	Doresa
		GSAT 202	Elliptic Orbit	Milena
	L4 (27/03/2015)	GSAT 203	Nominal	Adam
		GSAT 204	Spare	Anastasia
	L5 (11/09/2015)	GSAT 205	Nominal	Alba
		GSAT 206	Nominal	Oriana
	L6 (17/12/2015)	GSAT 208	Nominal	Andriana
		GSAT 209	Nominal	Liene
	L7 (24/05/2016)	GSAT 210	Nominal	Danielė
		GSAT 211	Nominal	Alizée
	L8 (17/11/2016)	GSAT 207	Nominal	Antonianna
		GSAT 212	Nominal	Lisa
		GSAT 213	Nominal	Kimberley
		GSAT 214	Nominal	Tijmen
	L9 (12/12/2017)	GSAT 215	Nominal	Nicole
		GSAT 216	Nominal	Zofia
		GSAT 217	Nominal	Alexandre
		GSAT 218	Nominal	Irina
	L10 (25/07/2018)	GSAT 219	Nominal	Tara
		GSAT 220	Nominal	Samuel
		GSAT 221	Nominal	Anna
		GSAT 222	Nominal	Ellen

Open Service (OS) and Authentication
- Free and Open Positioning Navigation & Timing (3 frequencies)

Public Regulated Service (PRS)
- Encrypted, more robust, unlimited & uninterrupted access

Search and Rescue (SAR) - contribution
- Forward link + **acknowledgement "return link"**

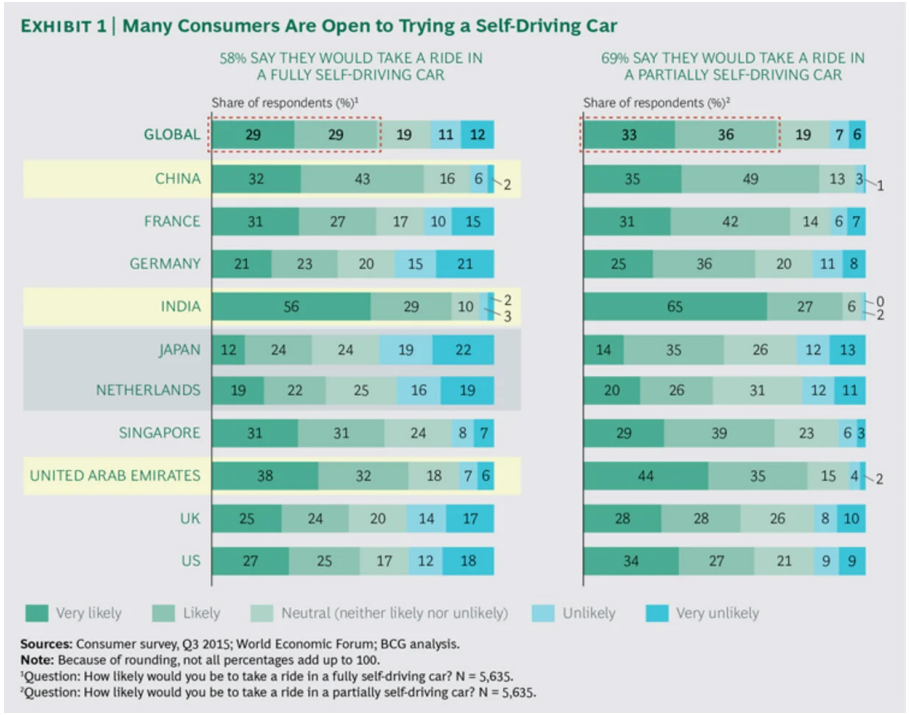
High Accuracy and Authentication
- **Free High accuracy services + signal authentication services**

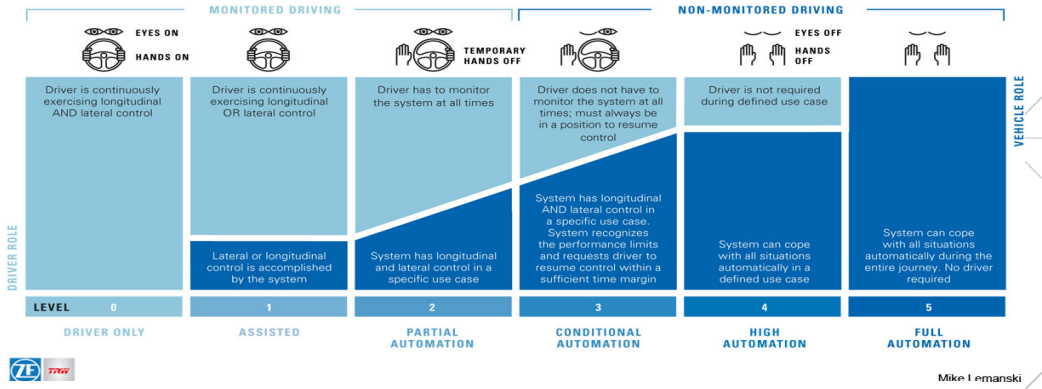
Driverless cars are becoming reality

Forecast on autonomous driving adoption[1]:

- 20% of new car sales in 2025
- 44 million vehicles by 2030

[1] Boston Consulting Group (2015) Revolution in the Driver's Seat: The Road to Autonomous Vehicles

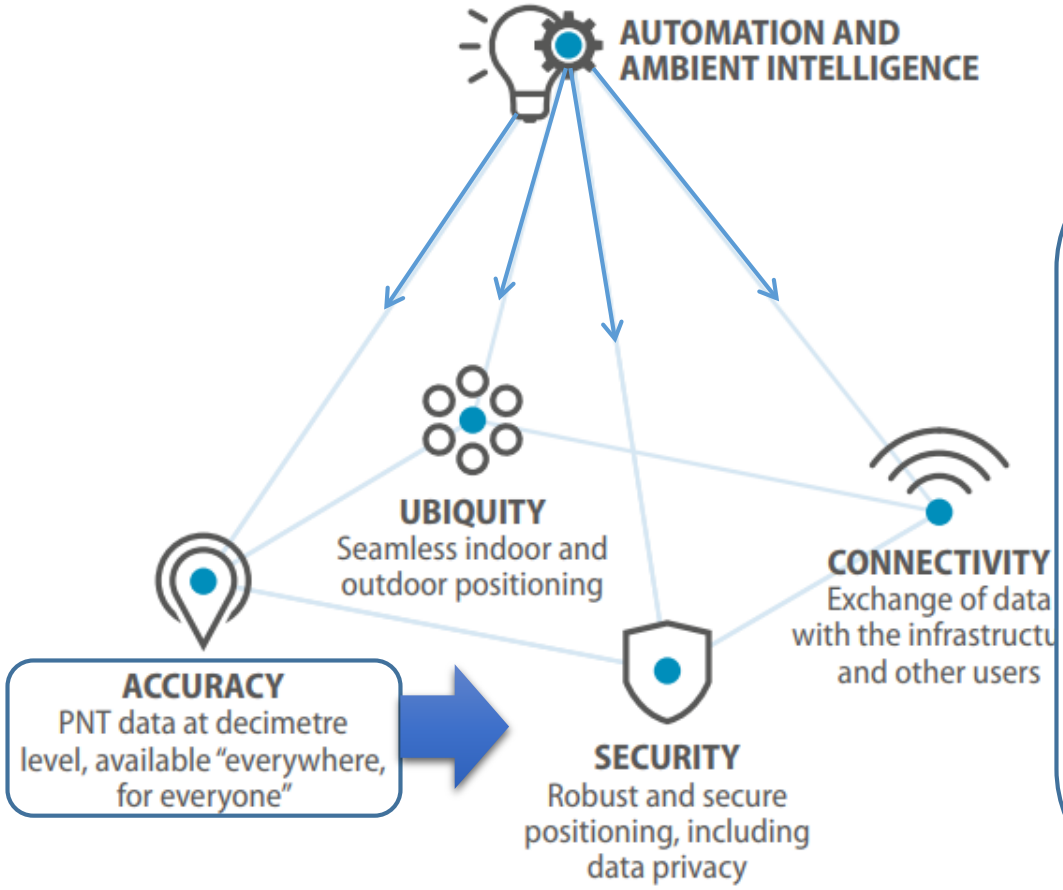




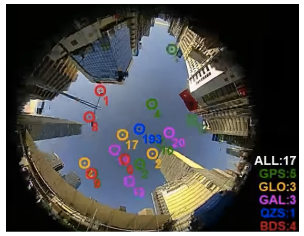
Mike Lemanski

Photo: Mike Lemanski / ZF TRW; Source: The Society of Automotive Engineers (SAE)

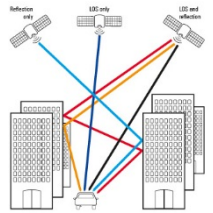
Galileo contribution to the automated mobility challenge



Contribution of Galileo High Accuracy



Multi-constellation & Multi-frequency (E1/E5)
+ PPP / RTK techniques



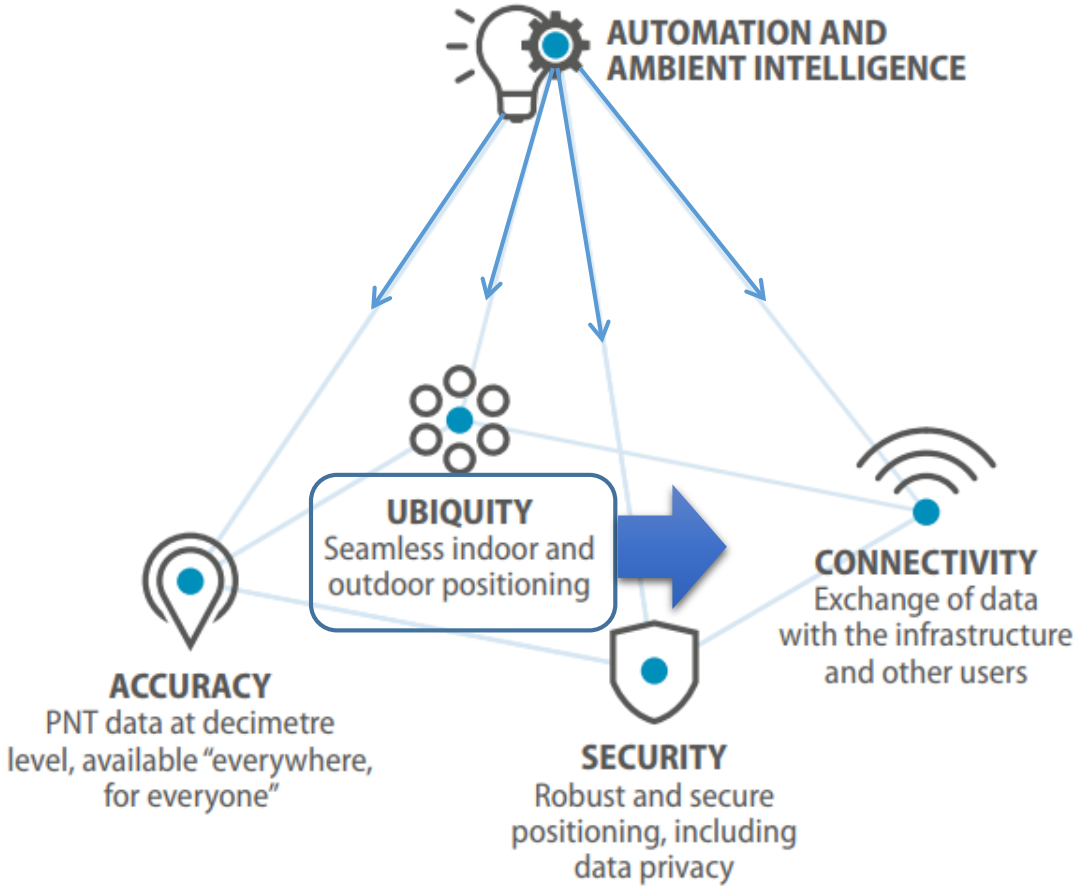
Upcoming

High Accuracy service will bring a decimeter level error:

- *based on the Galileo E6b signal*

- Positioning accuracy with **decimeter level error (≈*20cm*)** depending on user receiver, algorithms, environment…
- ((No need of proximity to base stations to access corrections))

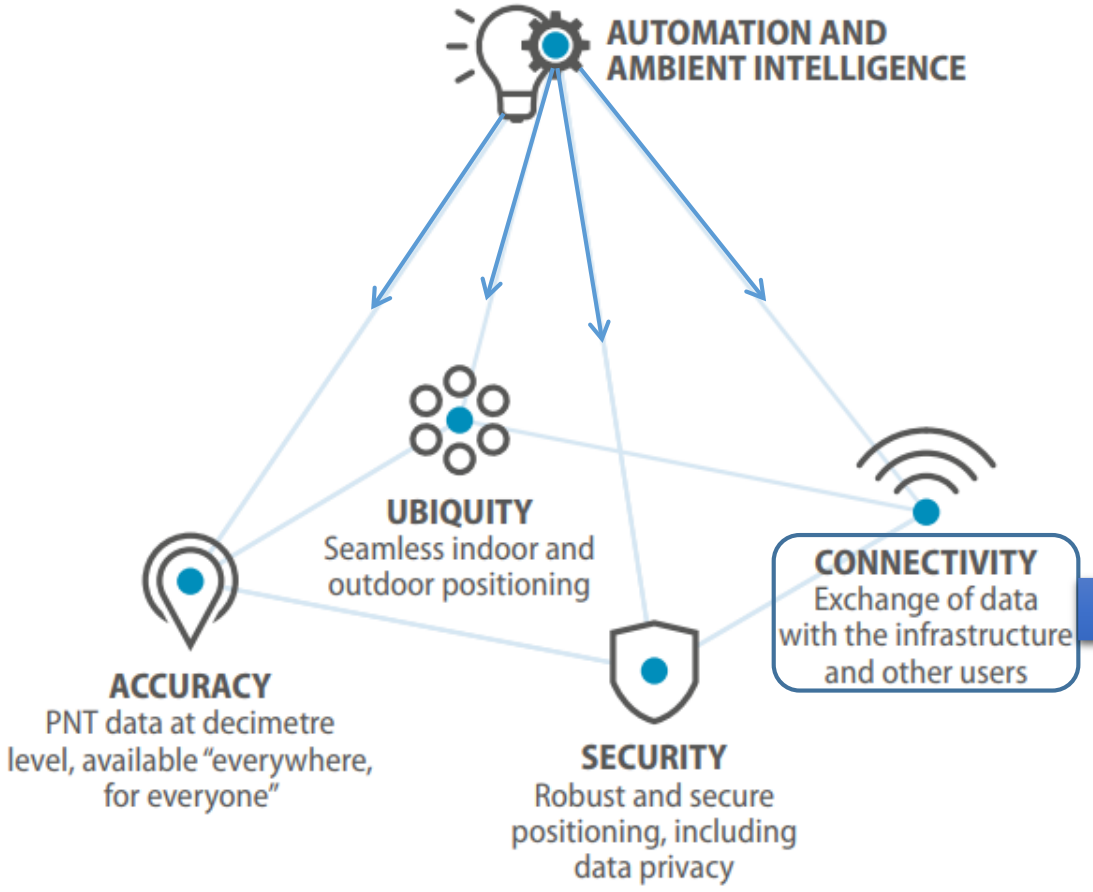
Galileo contribution to the automated mobility challenge



GNSS hybridization with other sensors

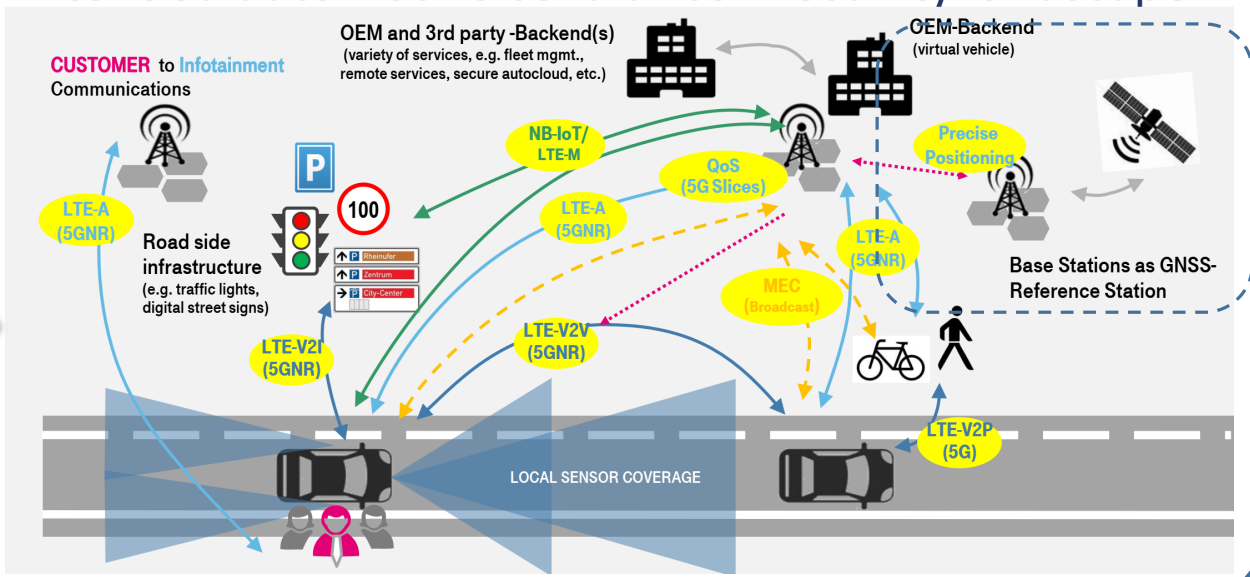
Source: Bosch

Galileo contribution to the automated mobility challenge



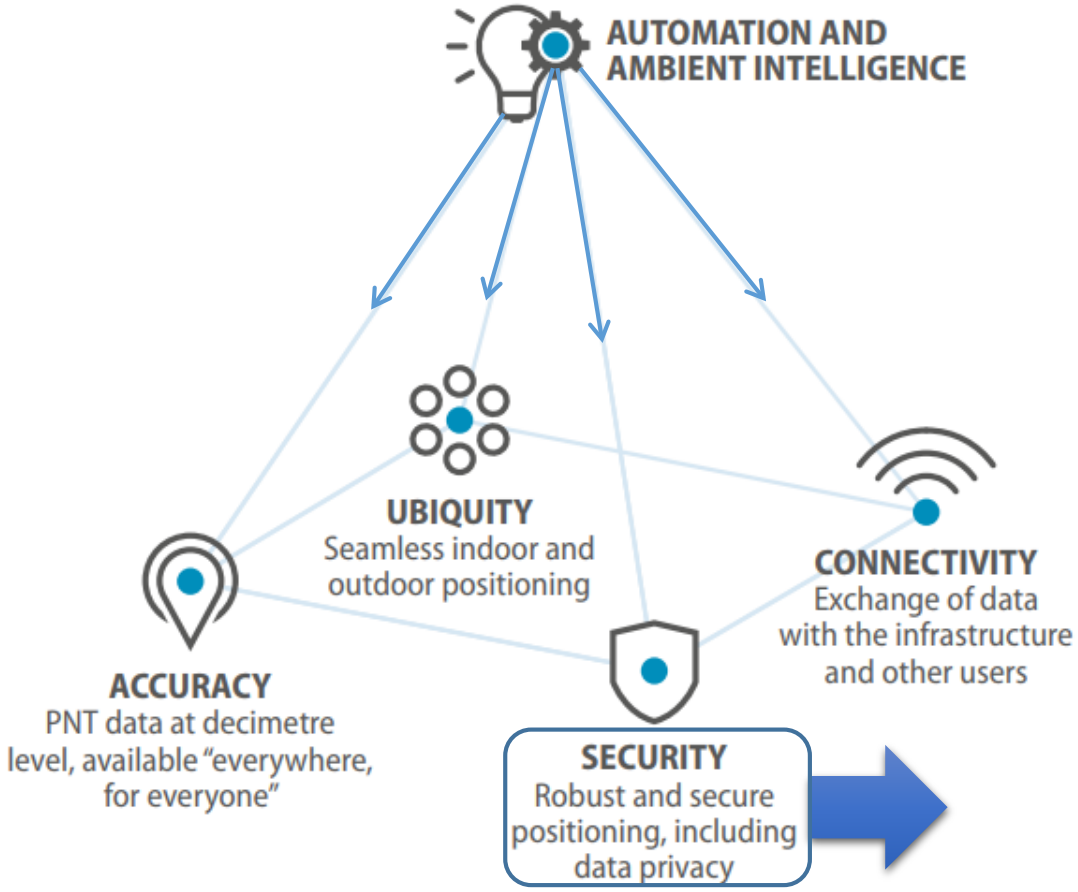
GNSS Integrity/High Accuracy corrections via 5G

Extended automotive cellular connectivity landscape



Source: Deutsche Telekom

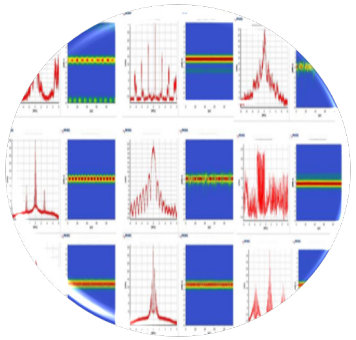
Galileo contribution to the automated mobility challenge



JAMMING can lead to degradation or denial of service

RF Interference (RFI) events are growing

- About 73.000 interferences have been identified and classified
- 23 countries around the globe
- Vast majority are unintentional



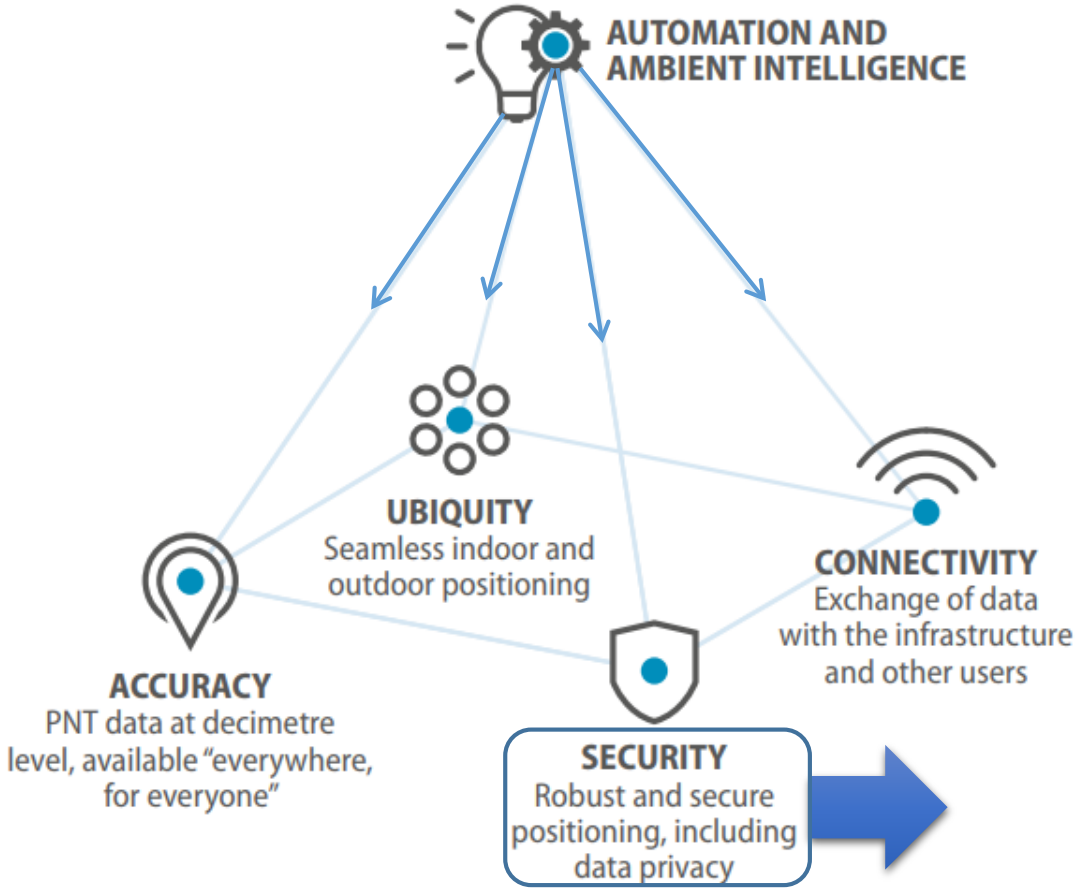
GALILEO SOLUTION TO RFI:

- ✓ FREQUENCY DIVERSITY (E1, E5, E6)
- ✓ WIDE-BAND SIGNALS (ALTBOC)
- ✓ TECHNOLOGY DIVERSITY / SENSOR FUSION

STRIKE3

HORIZON 2020

Galileo contribution to the automated mobility challenge



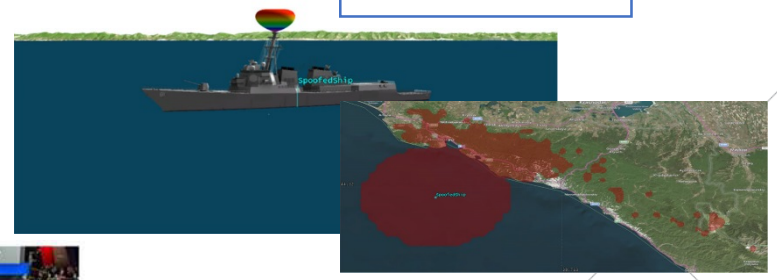
SPOOFING is an emerging and more dangerous threat

Spoofing events are increasingly reported
- Motivation increasing
- Price decreasing

DEC 2015 - USA-MEXICO

DHS: Drug Traffickers Are Spoofing Border Drones

JUNE 2017 - BLACK SEA



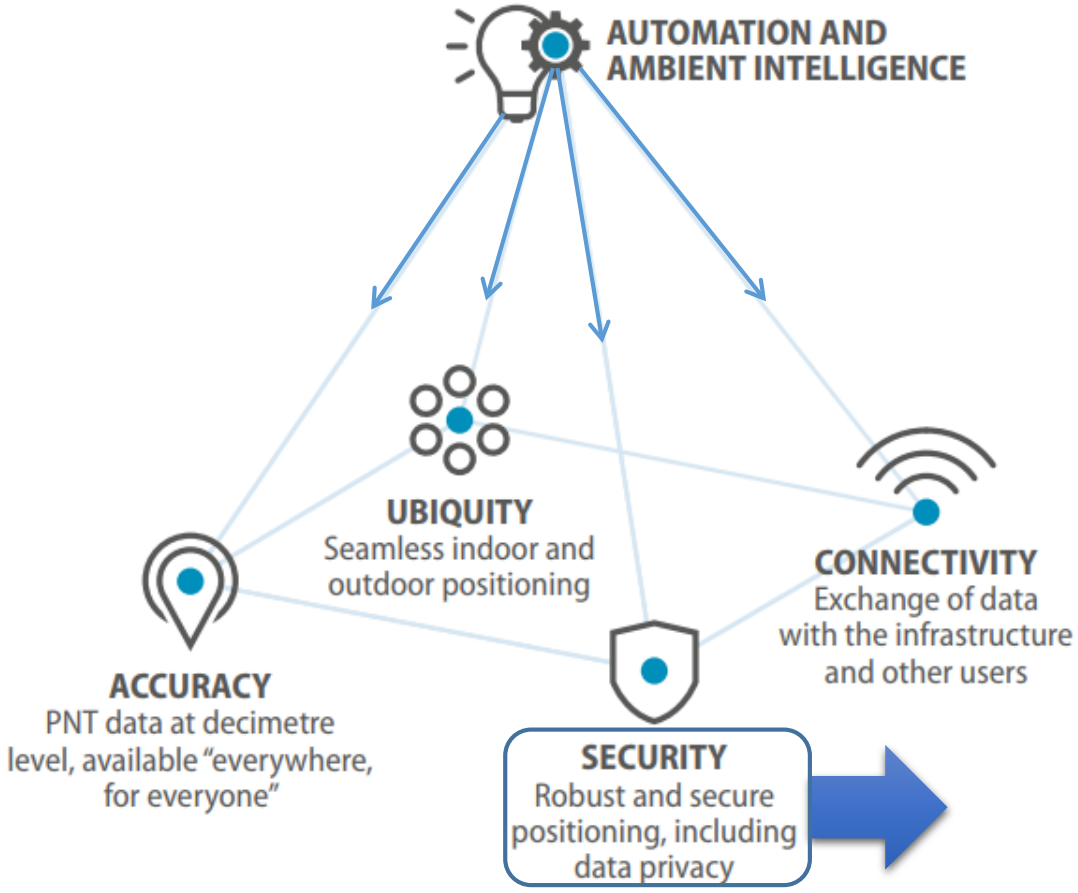
APR 2019 – GENEVA MOTOR SHOW

INDUSTRY VOICES

GPS Spoofing Mystery Affirms Need for Protection

GALILEO SOLUTION TO SPOOFING:
- ✓ NAVIGATION MESSAGE AUTHENTICATION
- ✓ SIGNAL AUTHENTICATION SERVICE
- ✓ TECHNOLOGY DIVERSITY / SENSOR FUSION

Galileo contribution to the automated mobility challenge



SPOOFING is an emerging and more dangerous threat

Coming soon!

Galileo Authentication capability will mitigate spoofing attacks:

- *Galileo E1 Navigation Message Authentication*
- *Galileo E6 Spreading Code Authentication*

- The UNECE World Forum for automotive regulations declared the need of clear **cybersecurity rules**:
  - ✓ GNSS authenticated message is recommended

UNECE

Increasing automation level (co-)funded by the GSA

L3

L4

L4/5

OVER 15M€

COMMITTED TO DEVELOP GNSS DOWNSTREAM IN AUTONOMOUS MOBILITY

InDrive

FCA FIAT CHRYSLER AUTOMOBILES

MAGNETI MARELLI

CRF

BASELABS

inLane Lane Navigation Technology

TOMTOM

HONDA

intel

ceit IK4 Research Alliance

Fraunhofer

waysure

PROPART Precise and Robust Positioning for Automated Road Transports

commsignia

SCANIA

BASELABS Data Fusion Results

RI. SE

ASTAZERO ACTIVE SAFETY TEST AREA

EUROPEAN SAFETY CRITICAL APPLICATIONS POSITIONING ENGINE

FICOSA

GMV INNOVATING SOLUTIONS

GROUPE RENAULT

life.augmented

IFSTTAR

ISMB Istituto Superiore Mario Boella

ADDITIONAL 2 PROJECTS KOM IN Q1 2020

European Global Navigation Satellite Systems Agency

Fundamental Elements

GSA funding opportunities

Opening: 5th of November 2019
Deadline: 5th March 2020

Type of Action *	Topic	Indicative budget (EUR mln)	Funding rate	Indirect costs
IA	EGNSS applications fostering green, safe and smart mobility	**10**	**70%** (except for non-profit legal entities, where a rate of 100% applies)	25% of the total eligible costs excluding: • Subcontracting • Costs of resources made available by 3rd parties • Financial support to 3rd parties
IA	EGNSS applications fostering digitisation	**4**		
IA	EGNSS applications fostering societal resilience and protecting the environment	**4**		
PCP	EGNSS applications for public authorities pilot	**2**		

***IA**: activities aimed at producing plans and arrangements or designs for new, altered or improved products, processes or services.

Linking space to user needs

How to get in touch:

15 Years of EU Satellite Navigation

www.GSA.europa.eu

EGNOS-portal.eu

GSC-europa.eu

UseGalileo.eu