

Safe GNSS/Inertial Positioning by VMPS for Highly Automated Driving

Vehicle Motion and Position Sensor (VMPS)
Chassis Systems Control, Robert Bosch GmbH

Why?

Localization
on maps

Feature
localization

GNSS / Inertial
positioning

Why localization?

- ▶ Activation / deactivation
- ▶ Artificial horizon

Why GNSS / Inertial positioning?

- ▶ Redundancy for safety
- ▶ Robustness for use cases
- ▶ Optimal cost balance

Market requirement for GNSS systems

PERFORMANCE

- ▶ **Guaranteed** sub-meter range
- ▶ **Everywhere** (worldwide) and **always**

Automated driving

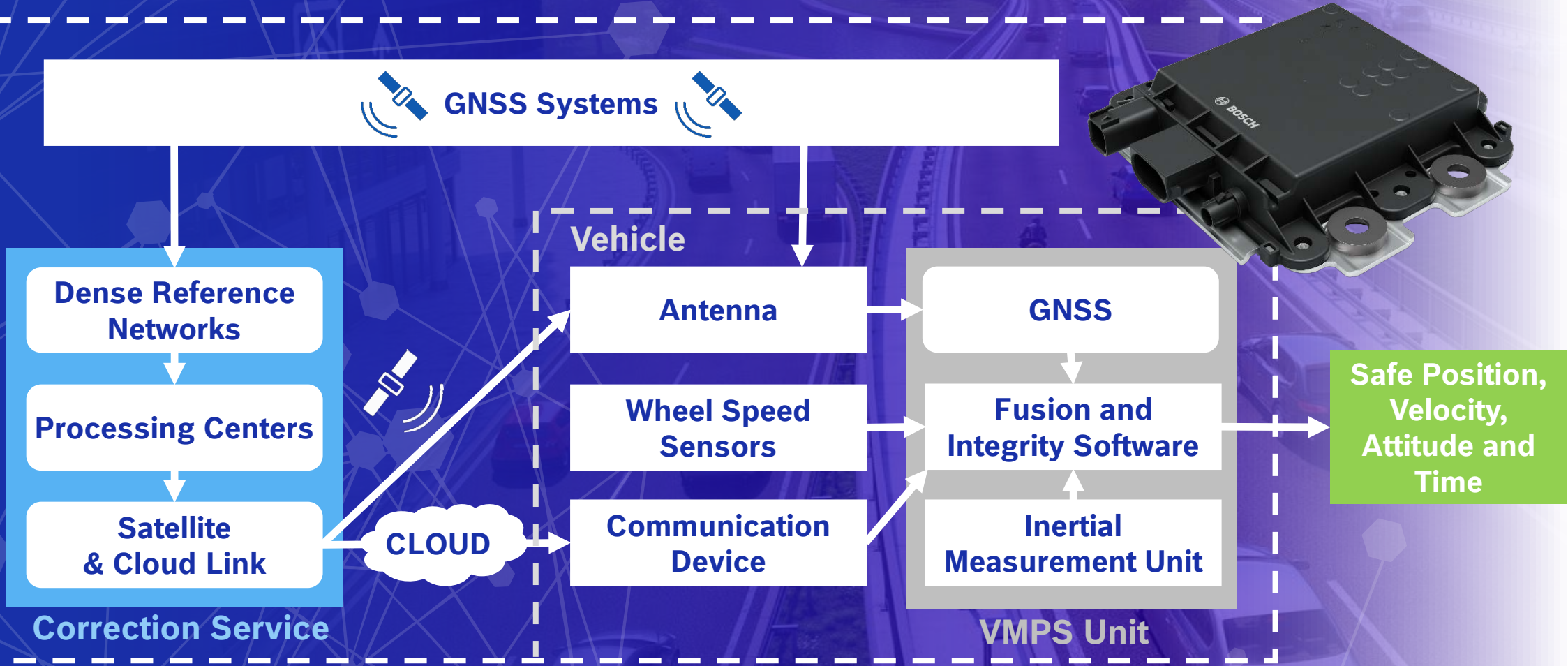
- ▶ **0 faults** policy
- ▶ **100% uptime in 24/7**
- ▶ Scalable and **cost sensitive**

SAFETY

- ▶ **Harsh** environments
- ▶ **ISO26262** compliant
- ▶ **Integrity** with hardware and functional safety **metrics**

AUTO-MOTIVE

Vehicle Motion and Position Sensor (VMPS)



VMPS System

Vehicle Motion and Position Sensor (VMPS)

▶ VMPS key parameters:

▶ Absolute position:

- ▶ General : 3D fused position: Typically 0.5-1m (1σ)
- ▶ Protection Limit (upper bound estimation): 4-10 m

▶ Relative position:

- ▶ 3D fused velocity: 3-5cm/s (1σ)

▶ Bridging correction data outages

- ▶ 90 sec

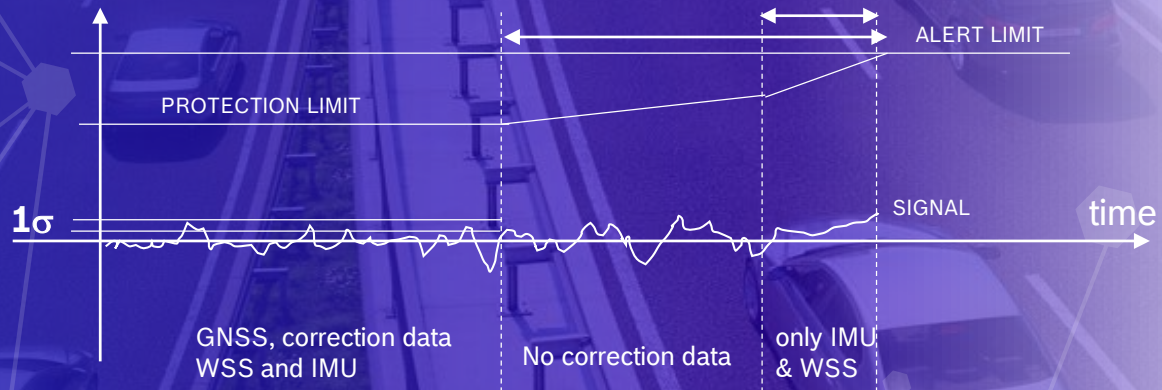
▶ Bridging GNSS outages

- ▶ 10 sec

▶ Safety level

- ▶ ASIL B for absolute position
- ▶ ASIL D for IMU raw signals

(note) depending on antenna quality / performance.
All values given refer to normal state of operation.



Summary

- ▶ GNSS/Inertial positioning will be a major building block for highly automated driving
- ▶ Vehicle Motion and Position Sensor consisting of high-end GNSS receivers, GNSS correction service, 6D inertial sensors as well as a high-end microcontroller
- ▶ VMPS (HW + service) fully compliant to automotive standards and ISO26262 – not available for today's GNSS products
- ▶ VMPS will be one of the first automotive products for safe GNSS/Inertial positioning with correction data