Luxoft
A DXC Technology Company

What you should know about intelligent speed assistance

by **Dr. Ulrich Wurstbauer**, Chief Technologist, Autonomous Driving
Andreas Mütsch, Senior Software Developer / Technical Writer

Get your speed right
or it gets you

Your next car should know how fast you're allowed to drive — and tell you. New EU regulations force car makers to install intelligent speed assistance (ISA) systems in their cars: ISA has been mandatory for new car types since July 2022, and it will be compulsory for all new cars sold in the EU from July 2024.

The warning light is on

The new EU regulations came as an unpleasant surprise for many automakers as they have just one year to equip new cars with electronic systems that assist the driver in sticking to speed limits. Making such changes in this time frame poses a big challenge to many automakers, while for those that didn't do their homework, it may already be too late.

Many cars that currently hit the road are not ready for ISA: They rely on old hardware that isn't capable of supporting the long update-cycle that the regulation demands. New hardware and update solutions are needed — now.

The procedures for getting the type-approval are also challenging. Rigorous and sophisticated testing is needed beforehand, demanding additional efforts: Tests sessions have to be planned and conducted, test results analyzed and changes implemented. All this takes time, making it even more difficult to keep the timeline.

A sporty timeline

The ultra-tight timeline calls for immediate action. Missing one of the points means that the type-approval is at stake and that such cars couldn't be sold within the EU anymore.

The details for ISA were announced in June 2021, with the new regulations coming in to force for new car models launched from July 2022 and for all new cars shipped from July 2024. However, there's no need to retrofit cars that are already on the market. For example, a car that was shipped in 2021 won't need to have an ISA system throughout its lifetime.

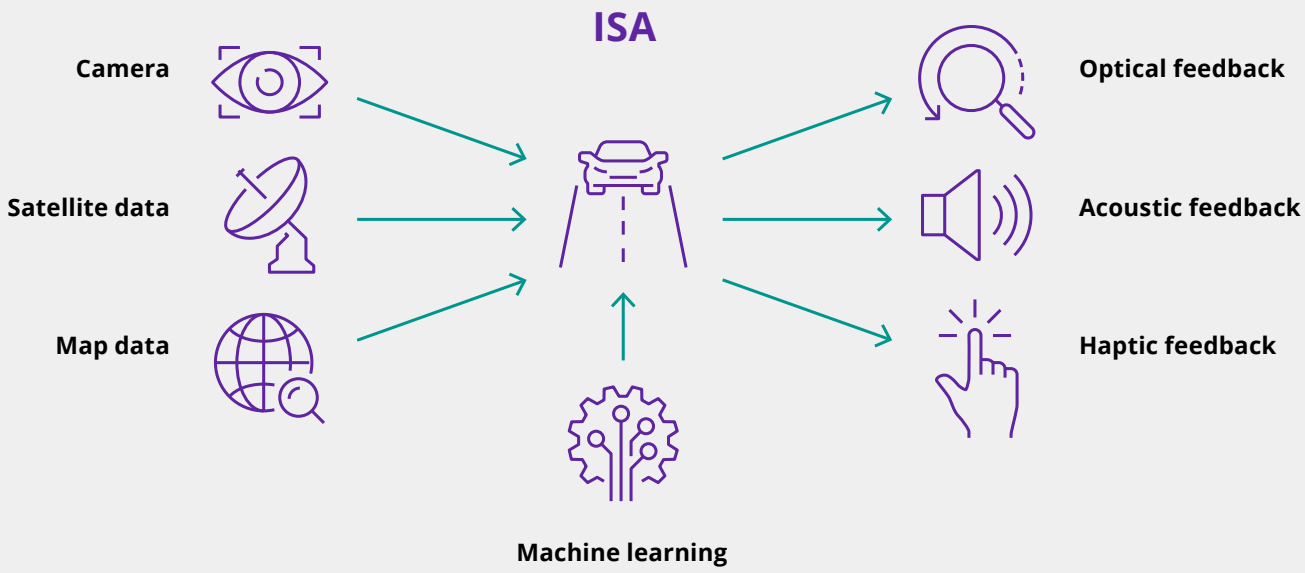
What is an **ISA system?**

An ISA system determines the current speed limit and assists the driver in keeping to it. We can think of an ISA as a system that combines a speed limit information function (SLIF) with a speed limit warning function (SLWF) or a speed control function (SCF). If a speed limit is detected and the car drives faster than allowed, the system provides visual, acoustic and haptic feedback to the driver. Some systems may also reduce engine torque or use the brakes to slow the vehicle.

Different types of systems

The regulation allows different configurations of ISA systems. Car makers can decide which input- and output-devices they use.

Figure 1: A typical ISA system with several devices and connected data sources



Much of the described technology is available in modern cars: Cameras are common with parking assistance; maps and satellite data are included in navigation systems; and functionality of other speed-related assistance systems, like cruise control or emergency braking systems, can also be used for ISA. The challenge is to combine all these technologies and make them work together to fulfill the strict test procedures that are defined in the regulation.

How does **ISA interfere?**

As an assistance system, the driver is always responsible for adhering to traffic rules (the system itself only provides recommendations and support). When combined with a cruise control system, ISA can slow down the car automatically by reducing the motor torque or even using the brakes — if ISA actively interferes like this, the driver can override the behavior by pushing the accelerator pedal harder. This way, the driver can deliberately exceed the speed limit to defuse a potentially dangerous situation. Other systems, like automated lane keeping, can also override ISA to fulfill their tasks.

Additionally, the driver can turn off the system partially or completely. However, with each restart of the vehicle the system will turn itself on again. This automatic reinstatement is well-known from start-stop-systems in modern cars, where the same rules apply.

Warning indications

The regulation describes three options of warning indications to the driver, from which car makers are free to choose:

Visual feedback

An optical indication such as a blinking sign showing the current speed limit in the cluster instrument

Acoustic feedback

A cascaded audio warning such as beeping sounds or an audible announcement through the speaker system

Haptic feedback

A perceptible indication such as making the acceleration pedal vibrate or become stiffer

The behavior of each warning indication is specified further in the regulation.

A closer **look at the regulations**

The EU has adopted several regulations regarding the type-approval of vehicles. Without a type-approval, you're not allowed to sell vehicles of this type within the EU.

With the ISA-specific regulations, the EU hopes to cut down the number of traffic deaths. Collisions that are caused by exceeding the speed limits are a major contributor to the total traffic casualty toll. A study of the European Transport Safety Council (ETSC) suggests that ISA systems could reduce speed-related collisions by 30% and associated fatalities by 20%.

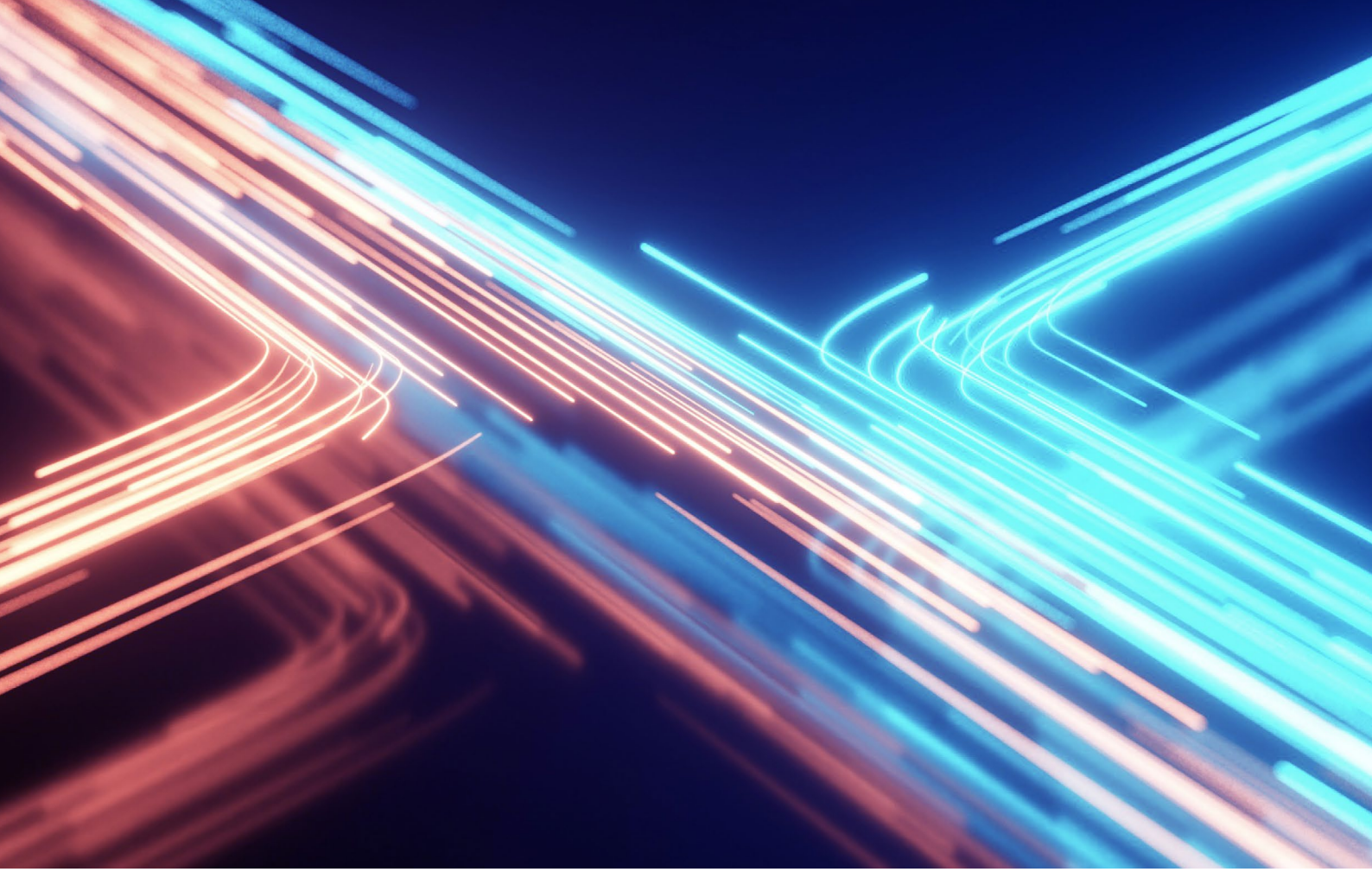
ISA-specific regulations:

- **(EU) 2019/2144** establishes requirements for the type-approval of vehicles and vehicle systems with regard to safety in general

- **(EU) 2021/1958** supplements the first regulation. It defines procedures and technical requirements specifically for intelligent speed assistance systems. From now on we shall refer to it as 'the regulation' within this text

The regulation defines the following details:

- The types of vehicles for which the regulation is valid
- Technical requirements and options for realization
- Options for driver feedback
- Test procedures and conditions
- A catalogue of road signs presenting the different national varieties found in EU member states



Challenges of **sign recognition**

Before an ISA system can indicate a speed limit, it has to detect one. In cases of camera-based sign-recognition, this can be tricky as detection systems have to cope with various sign appearances:

- Different types of signs, such as dedicated or implied speed limits
- Different designs, varying throughout the member states of the EU
- Unexpected changes in sign appearance (e.g., overgrown or vandalized signs)

To learn more about this, stay tuned for a follow-up article about the challenges of sign recognition.

Testing is key

ISA systems have to cope with all these kinds of road signs to deduct the current speed limit. The same is true for other autonomous drive (AD) and automated driving assistance systems (ADAS). But for AD and ADAS functions, datasets that can be used for testing are often available, as they were already created during development. If you have a test environment at hand that can use these datasets for automated open-loop tests, you're one step nearer to passing the type-approval test procedures.

Final destination type-approval **Test procedures**

ISA systems have to prove that they fulfill the requirements by going through a series of tests. The regulation describes the test procedure for achieving type-approval in detail. Let's focus on the main points.

Real-world testing

The regulation demands a test drive of 400 kilometers of real-world driving on open roads or special test tracks. The test drive tackles three different kinds of roads:

- Urban roads and streets
- Non-urban roads
- Motorways, expressways and divided highways

The systems have to recognize the speed limits on each road-type with an accuracy of at least 80%, and an overall accuracy of at least 90% is needed to fulfill the requirements.

Bear in mind that passing a test drive of 400 kilometers requires several orders of magnitude more kilometers to be driven during the development phase. However, as opposed to the type-approval test drive these development tests can take place both in real and virtual worlds.

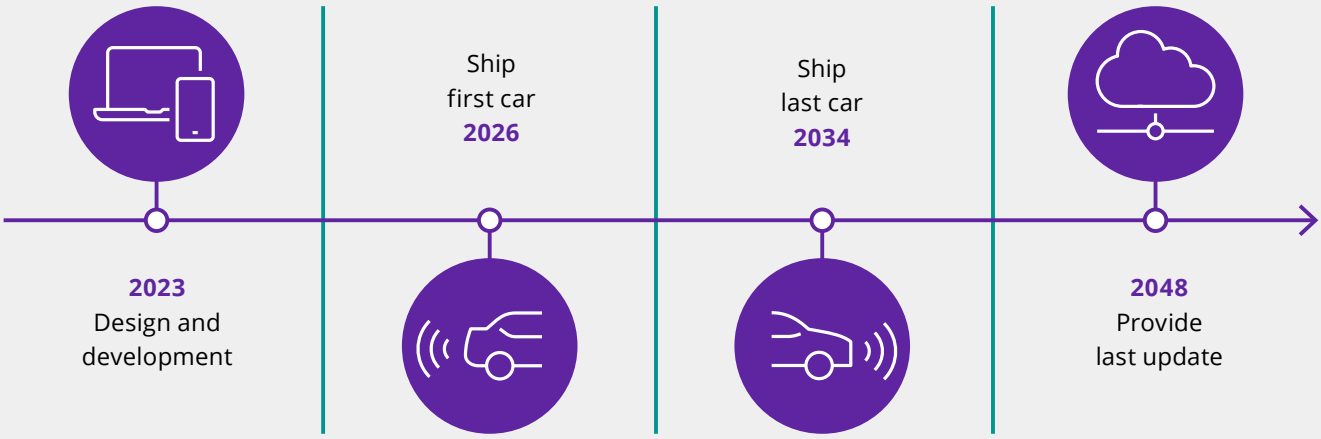
Car makers that use a software-defined vehicle or a digital twin in this development phase have one big advantage — they can accelerate the testing considerably and gain huge potential to minimize efforts and meet the timeline of the regulation.

Updates, **the long-term challenge**

Speed restrictions constantly change. Around 10% of speed limits are altered every year. Therefore, the regulation demands at least yearly updates of the data. This update cycle has to continue for at least 14 years after the manufacture date of the vehicle (the first 7 years have to be free of charge for the customer).

Consider this: A new car type usually takes around 3 years to develop, it's then sold for around 8 years. This means that a car type whose development has just started has to get updates till 2048.

Figure 2: Car update time span for ISA systems



This long update-maintenance time span may be the most challenging part for automakers, especially because current car types aren't fitted with technology that allows for easy updates.

Propelling the industry toward software-defined vehicles

The update mechanism itself isn't specified in the regulation, so both online (over-the-air) and offline (e.g., via USB/SD) solutions are possible. Some manufacturers might be tempted to opt for manually performed offline-updates, but handling them on a large scale for more than a decade involves high risks.

The far better solution is to use the flexibility of automated online updates that only a software-defined vehicle (SDV) can provide. With SDVs and over-the-air update mechanisms, cars can receive new software without having to visit a garage at all. Car makers can even select and update just a subset of vehicles while not interfering with other cars of the same type driving on the roads.

Digital twins — a testbench-based digital copy of the hardware and software of a real car — offer manufacturers even more advantages: They can save effort with faster development cycles and more flexible test handling. In the insights section of our website, you can read more about the potential of developing and testing with SDVs and digital twins.

Speed up to succeed

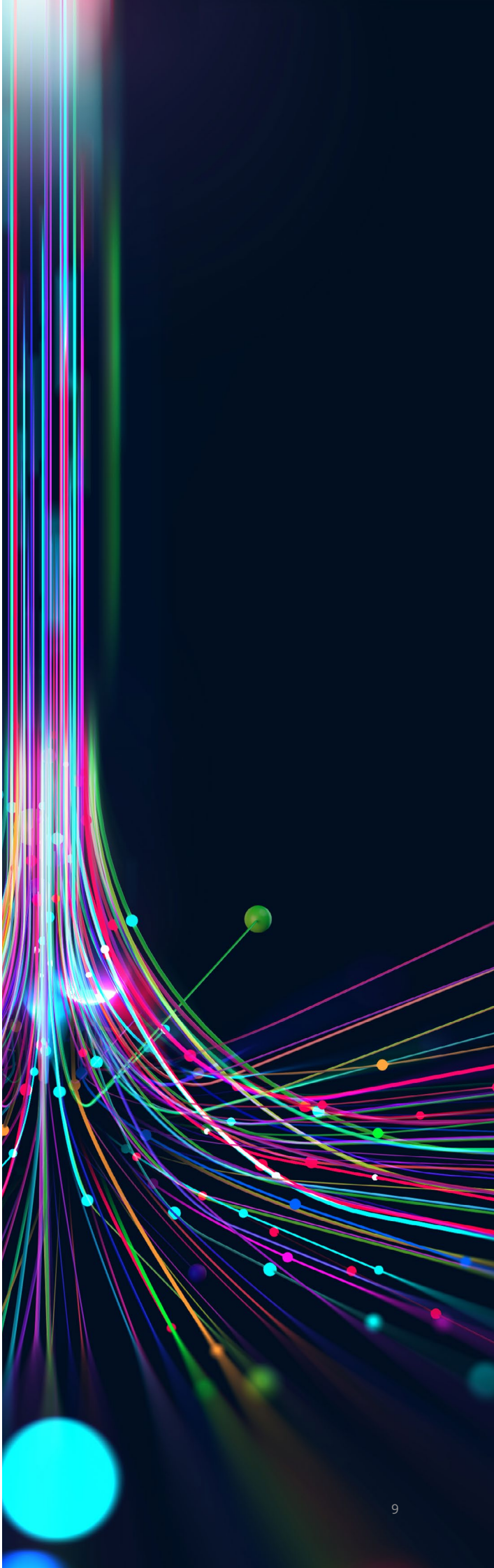
As we've seen, the ISA regulation calls for quick responses in several fields of development and testing. Car makers have to speed up to develop compliant ISA systems and to remain successful in the EU market. External suppliers are well advised to stand by and offer the extra push.

At Luxoft, we offer a whole portfolio of expertise to help you win this race:

- Do you need help with generating and implementing future-proof AD/ADAS functions?
- Are you struggling to nail your hardware specifications?
- Do you want to shorten your development times by virtualizing electronic control units and running more simulations in a shorter time?
- Are you planning to process large datasets in a cloud-based or on-premises test environment?
- Do you need manpower to do all the system testing and milage collections?

We can help you accelerate toward such SDV needs. Our **Automotive Advisory** section can even develop a general strategy for you to cope with this legal setup.

No matter what, we can help: **Get in touch**



About **the authors**

Dr. Ulrich Wurstbauer
Chief Technologist, Autonomous Driving

Dr. rer. nat. Ulrich Wurstbauer is chief technologist for autonomous driving at Luxoft. He's responsible for strategic developments in the field of autonomous vehicles, AD function development and virtual validation. Before starting his work on automotive technologies — with a strong focus on simulation, digital twin technologies and cyber-physical systems — he received his PhD in the area of solid-state physics. As post-doc, he continued to work on the newly developed 2D-material graphene with its unique quantum physics behavior. Ulrich has authored more than a dozen research papers in addition to filing four national and international patent applications.

Andreas Mütsch
Senior Software Developer / Technical Writer

Andreas is a technical writer and former software developer at Luxoft. As part of the solutions team, he's responsible for the accuracy and reliability of technical articles and documentation. As a software developer, he helped to bring several generations of in-car infotainment systems to market. Andreas studied applied physics with a focus on opto-electronics and digital data processing. He's also an award-winning author of several books.

About Luxoft

Luxoft is the design, data and development arm of DXC Technology, providing bespoke, end-to-end technology solutions for mission-critical systems, products and services. We help create data-fueled organizations, solving complex operational, technological and strategic challenges. Our passion is building resilient businesses, while generating new business channels and revenue streams, exceptional user experiences and modernized operations at scale.

luxoft.com