NEXT GENERATION MOBILITY
SATELLIC TELEMATIC SERVICES
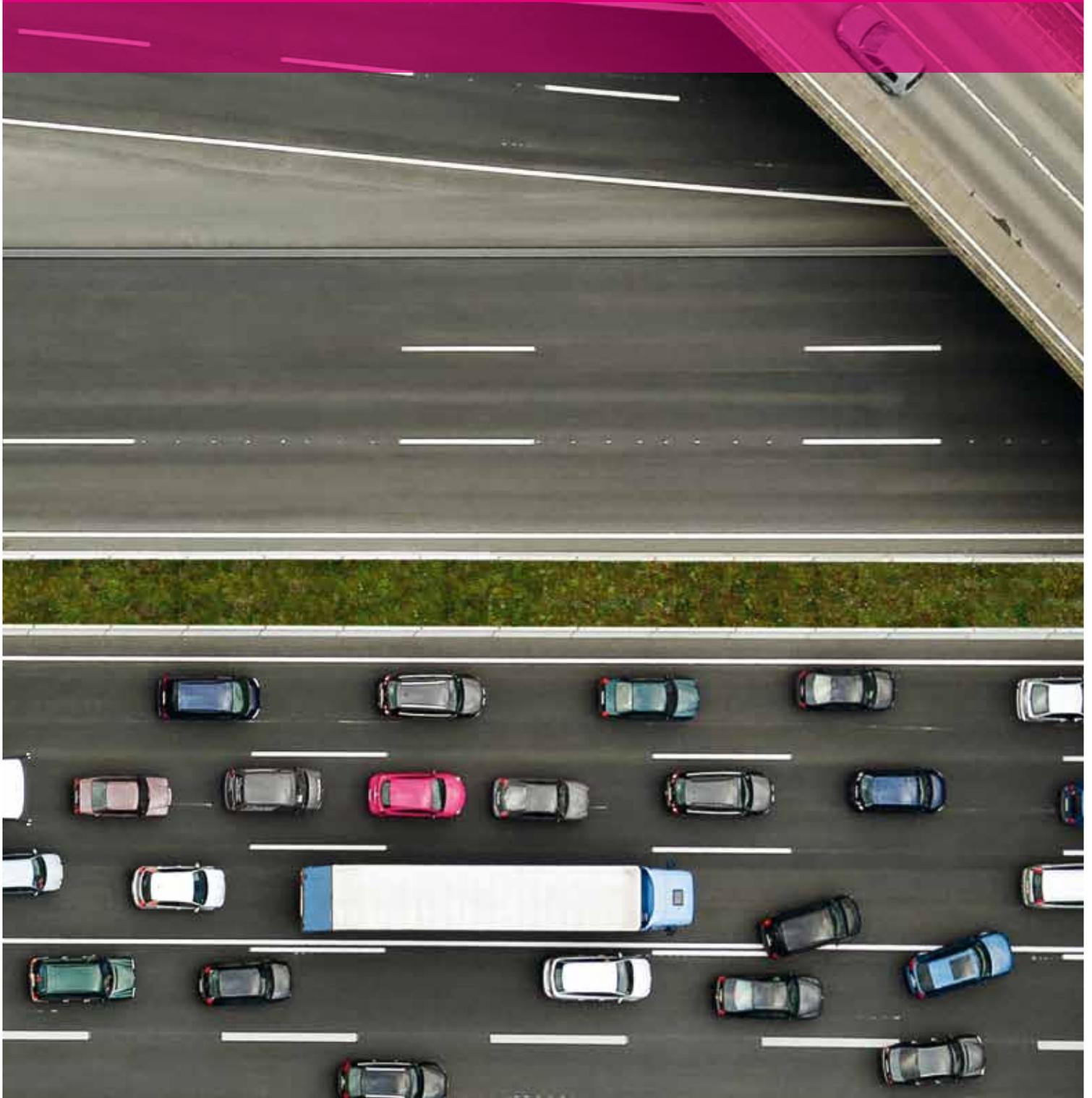
T··**Systems**·

T-SYSTEMS AND SATELLIC – A LONG-STANDING PARTNERSHIP TAKES THE NEXT STEP

T-Systems boasts an impressive record when it comes to road charging and telematic services. Over 10 years ago, we pioneered GNSS tolling technology by designing and implementing major parts of the German HGV (Heavy Goods Vehicle) tolling system. In 2005, T-Systems formed the Satellic Traffic Management GmbH subsidiary, with the aim of developing a next-generation road charging system based on experience gained from the German project, and to address the growing international market.

In late 2010, Satellic Traffic Management GmbH merged with T-Systems, becoming part of the Public Sector & Healthcare division and renamed Satellic Telematic Services. Satellic's unique expertise in key technologies is not only a valuable resource in the road charging space: it is also an important foundation for the provision of high-quality solutions in many other emerging fields of application. Telematic concepts are a key focus of the strategy in place at Deutsche Telekom AG and T-Systems International GmbH.

SATELLIC TELEMATIC PLATFORM – THE SOLUTION TO EUROPEAN TOLLING CHALLENGES

With its extensive experience in road charging and telematic technology and markets, T-Systems has designed and implemented a platform perfectly suited to the requirements of the EETS scheme. The result is highly versatile and flexible, meaning that small and stand-alone tolling programs, too, can also benefit.

T-Systems Satellic Telematic Services took part in the Road Charging Interoperability (RCI) project, whereby 27 major players in the European road charging market demonstrated the interoperability of existing and planned tolling systems. Co-funded by the European Commission, the project was designed to investigate the feasibility of and requirements for the planned European Electronic Toll Service (EETS). The overall aim of the EETS was to foster a competitive market of interoperable, user-friendly, single-contract toll services for Europe.

Based on the RCI project, T-Systems Satellic Telematic Services offers expertise both in terms of consulting and solutions – not only to toll service providers but also to toll chargers. The needs of toll chargers differ slightly and include provider monitoring, user compliancy checks and enforcement.

Based on experiences gained in Germany and in line with the challenges of an evolving market, we have developed the Satellic Tolling Platform (TP): a versatile and modular road charging system. Features include a high-quality GNSS-based onboard unit, a range of ready-to-use modules for device management, toll context management,

contract and financial management – and much more besides. The Satellic Tolling Platform is completed by a flexible ticketing system for electronic bookings (either for dedicated toll objects or as a fallback system for GNSS-based tolling). Moreover, it offers a customer self-service portal and a cockpit for the toll service provider, creating maximum transparency and enabling full reporting of business processes and their performance.

Its modular design means that the Satellic Tolling Platform can be easily integrated with legacy systems or third-party services. The soon-to-be-implemented EETS standards were taken into account. A range of value-added services that strengthen TSPs' business and improve customer retention in a competitive market can be selected from a set of standard services. These can then be specifically implemented with short time-to-market (TTM), in line with customer requirements. Furthermore, customer-specific services can also be implemented or migrated with minimum effort. As a result, the Satellic Tolling Platform is best suited to helping established service providers enter the EETS market with minimum effort, and without endangering existing business processes.
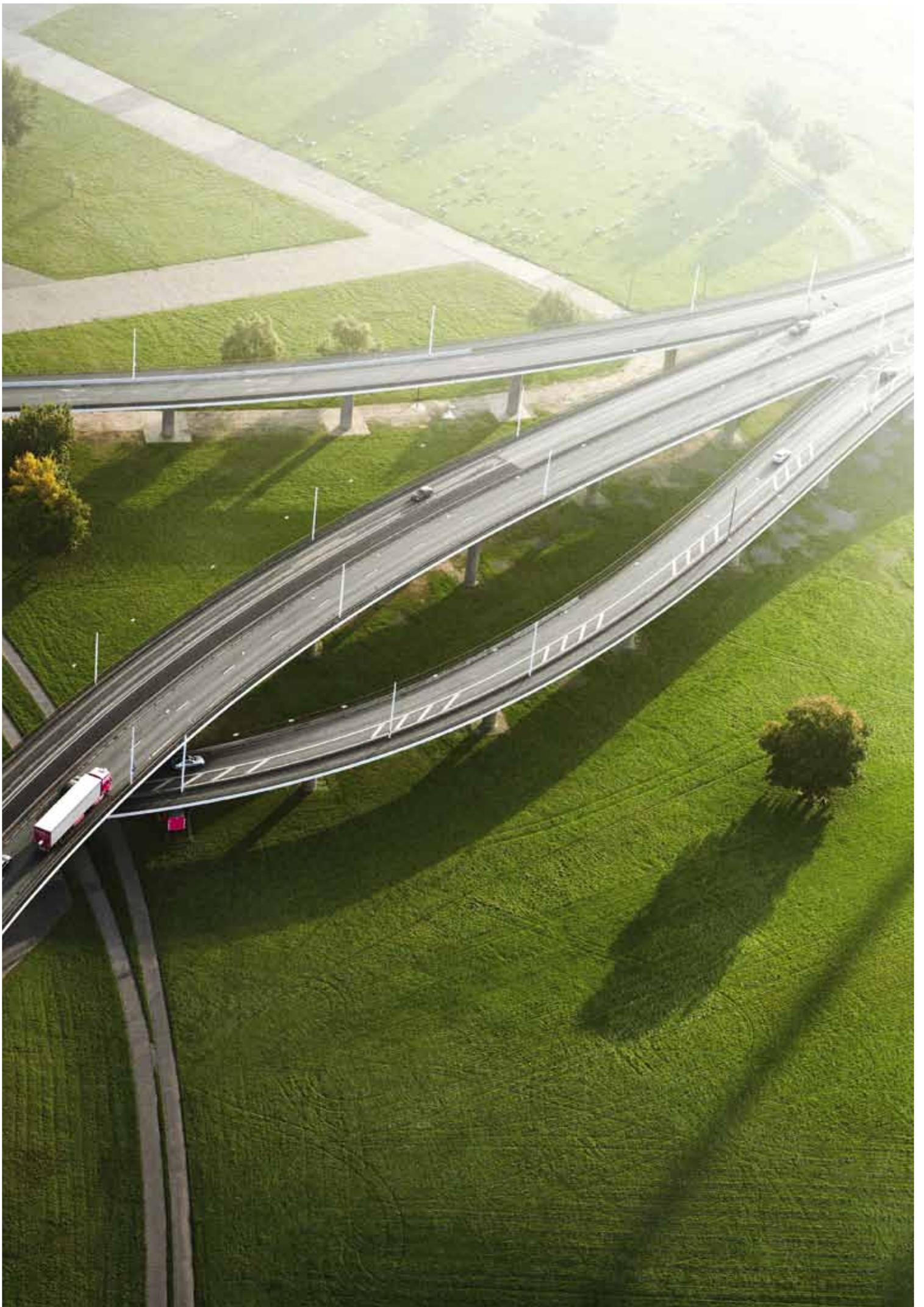
VEHICLE TELEMATICS AND CARBON FOOTPRINT

In addition to the Satellic Tolling Platform, which is focused on road charging applications, T-Systems has developed the Satellic Universal Telematic Platform (UTP), designed for fast and efficient implementation of telematic applications, and with ideal scaling properties that allow for the operation of groups of clients ranging from very small to large. UTP is available for all OSGi (Open Services Gateway initiative)-enabled devices and delivers a wide range of standard services, such as user and administration portals, tracking and tracing, configuration, user rights, and service management. Moreover, UTP features the map-matching and toll detection service also used by the Satellic Tolling Platform, together with a module called Emission Modeling, which records and reports the vehicle's CO_2 emissions in order to measure its carbon footprint.

The Satellic Universal Telematics Platform and the Emission Modeling module were deployed successfully in the "Pay as you Pollute" pilot project during EXPO 2010 in Shanghai. The project objective was to give local institutions and authorities in the Shanghai region access to mobile-phone-based GPS data. This data could then be used for traffic management and to help reduce CO_2 emissions. The system combined road user charging, parking fee collection and credit item functions (in line with emission zones with different ratings and local driver feedback). The project demonstrated that a traffic management system has a direct influence on driver behavior. Moreover, the system became the basis of training sessions to encourage eco-efficient driving for several logistics service providers, which is a current initiative in China.
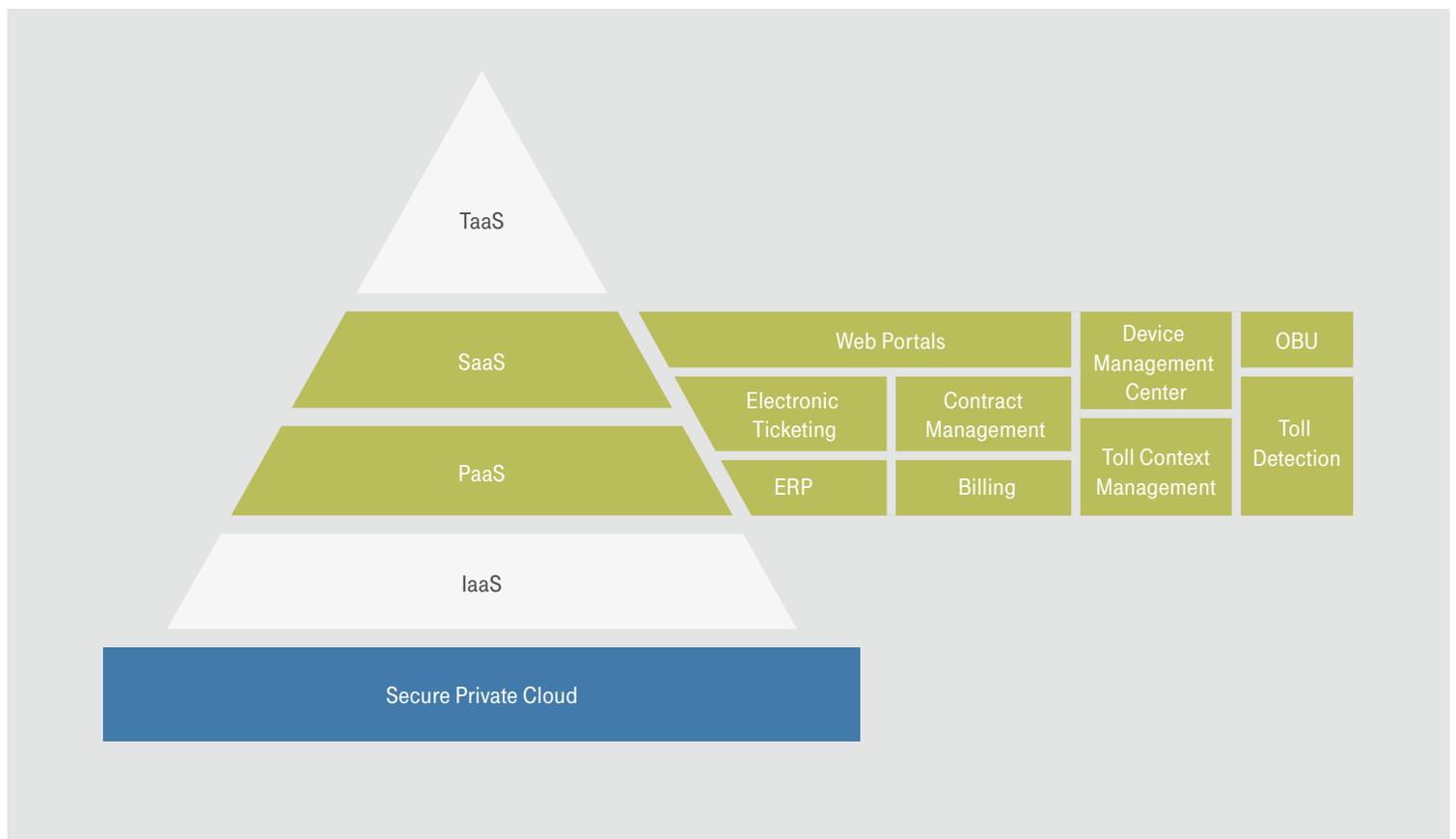
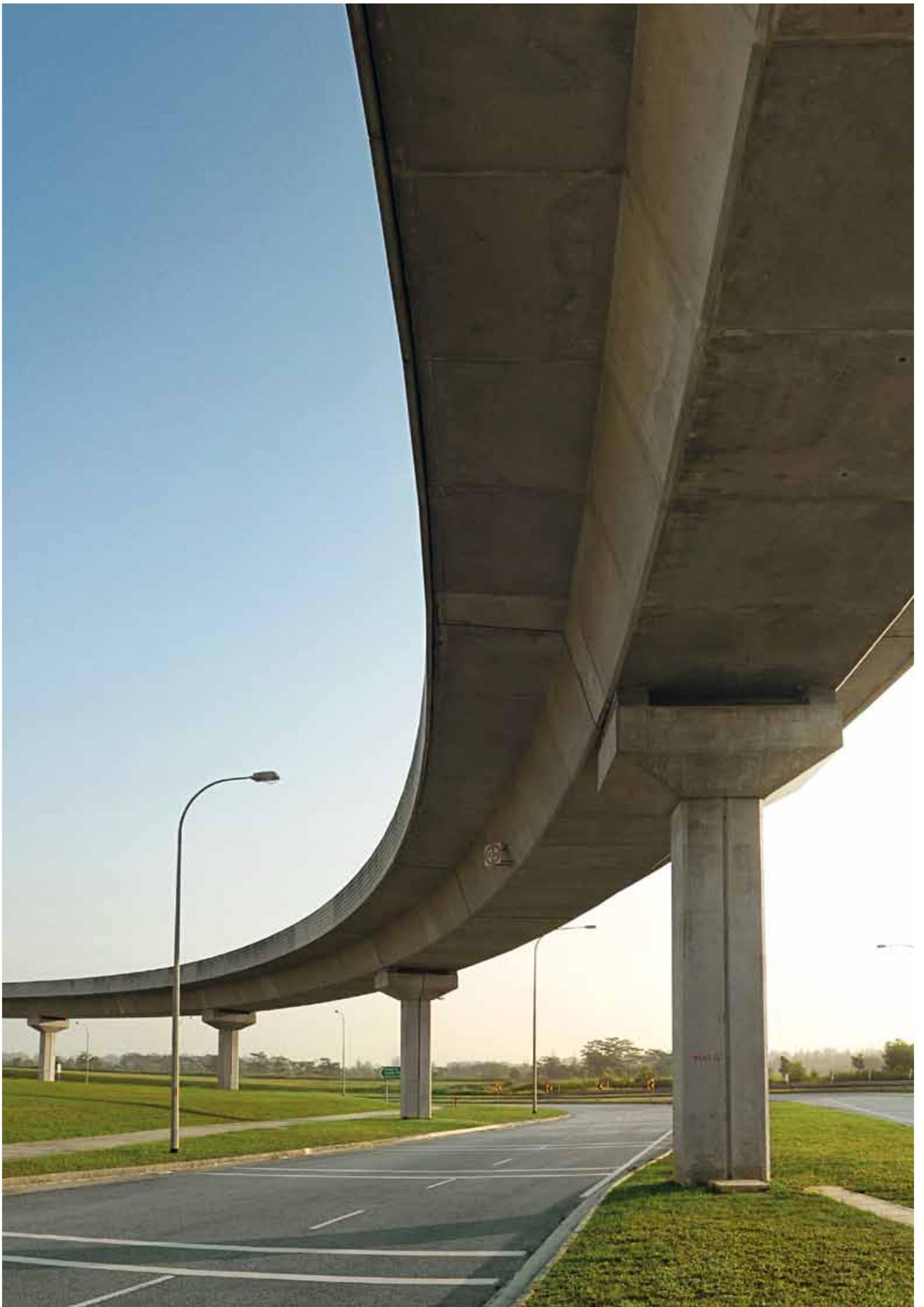# TOLLING AS A SERVICE: THE ONE-STOP SOLUTION

Cloud 7.0

Satellic Tolling as a Service (TaaS) offering is a one-stop business process outsourcing solution for toll service providers. TaaS combines components of the innovative Satellic Tolling Platform with well-established, effective business and operational processes. By opting for TaaS, toll service providers can leave tolling tasks to the systems operations specialists and focus on their core business. For standard components, the multi-vendor strategy pursued by T-Systems guarantees high quality at a reasonable price. Solution- and industry-specific system components are designed and implemented in collaboration with leading expert partners, providing the most reliable, high-performance and up-to-date applications.

Thanks to its modular and flexible architecture, the Satellic Tolling Platform is compatible with the T-Systems Cloud 7.0 portfolio. As a result, TaaS can be easily integrated with TSPs' existing business process landscapes and third-party offerings. And of course, it is also possible to provide customer-specific value-added services as required.

TOLLING AS A SERVICE

TaaS

SaaS

PaaS

IaaS

Web Portals

Electronic Ticketing

Contract Management

ERP

Billing

Device Management Center

OBU

Toll Context Management

Toll Detection

Secure Private Cloud

THE VERSATILE SOLUTION:
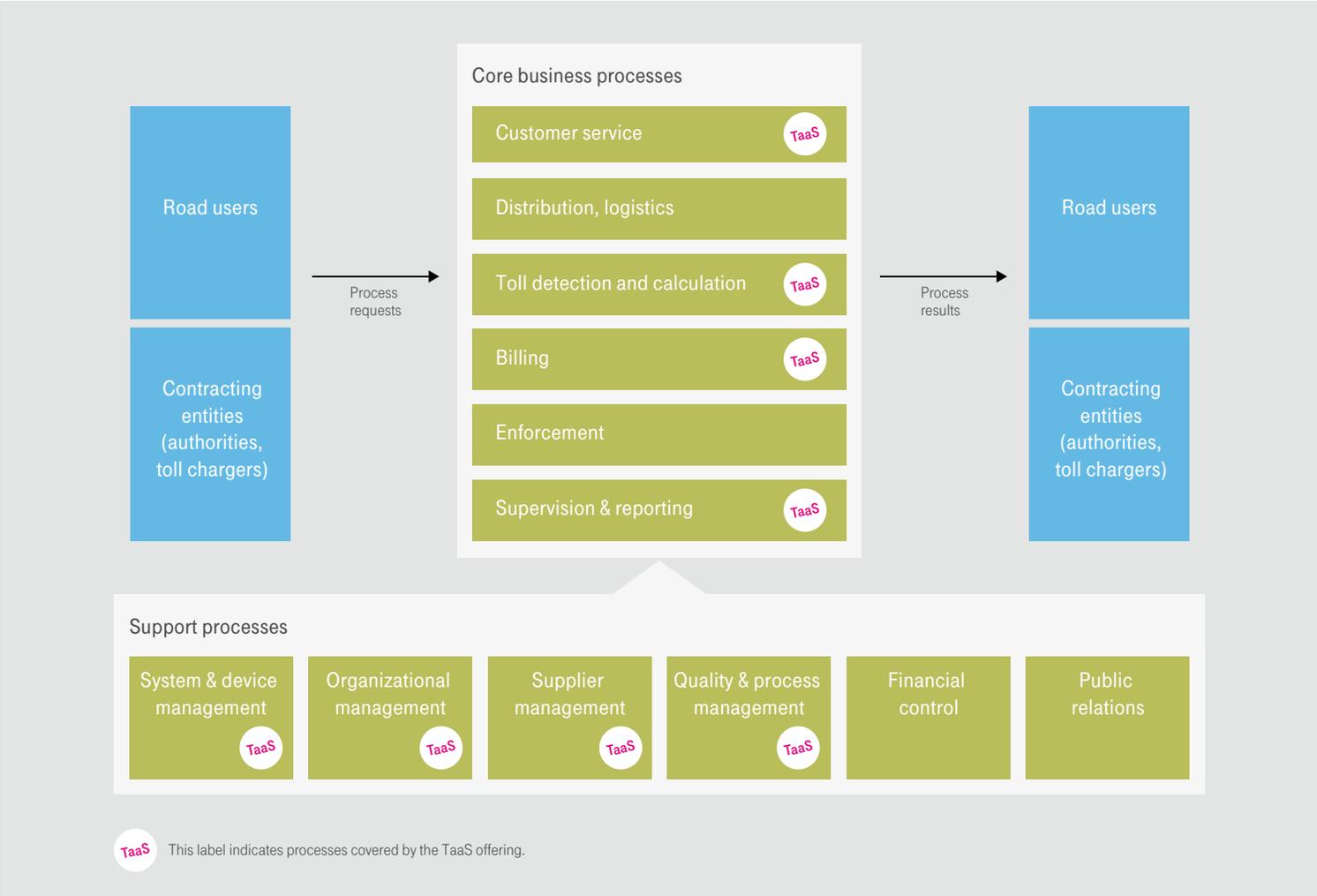# THE SATELLIC TOLLING PLATFORM

Over the last few decades, electronic toll collection has become increasingly significant in the financing and operation of transport infrastructures. At the same time, key technologies such as mobile communications (GSM/UMTS/LTE) and global navigation satellite systems (GNSS) have become robust and affordable, making it possible to overcome the systemic and commercial limitations of traditional charging approaches such as paper vignettes, toll plazas and short range communication systems (DSRC).

The Satellic Tolling Platform (TP) from T-Systems is a versatile and modular GNSS-based high-precision road charging platform. It is suitable for toll service providers (TSPs) currently entering the market against the backdrop of the European Electronic Toll Service (EETS), and for established providers who wish to add EETS offerings to their portfolio.

THE BUSINESS LANDSCAPE OF TOLL SERVICE PROVIDERS

TSPs' core business processes include detecting and calculating road user charges, managing payments, and maintaining the relationship with roads users and with contracting entities such as public authorities or EETS toll chargers.

TYPICAL CORE BUSINESS AND SUPPORTING PROCESSES OF A TOLL SERVICE PROVIDER

	Core business processes	
Road users	Customer service `TaaS`	**Road users**
	Distribution, logistics	
	Toll detection and calculation `TaaS`	
Contracting entities (authorities, toll chargers)	Billing `TaaS`	**Contracting entities (authorities, toll chargers)**
	Enforcement	
	Supervision & reporting `TaaS`	

Process requests → → Process results

Support processes					
System & device management `TaaS`	Organizational management `TaaS`	Supplier management `TaaS`	Quality & process management `TaaS`	Financial control	Public relations

`TaaS` This label indicates processes covered by the TaaS offering.
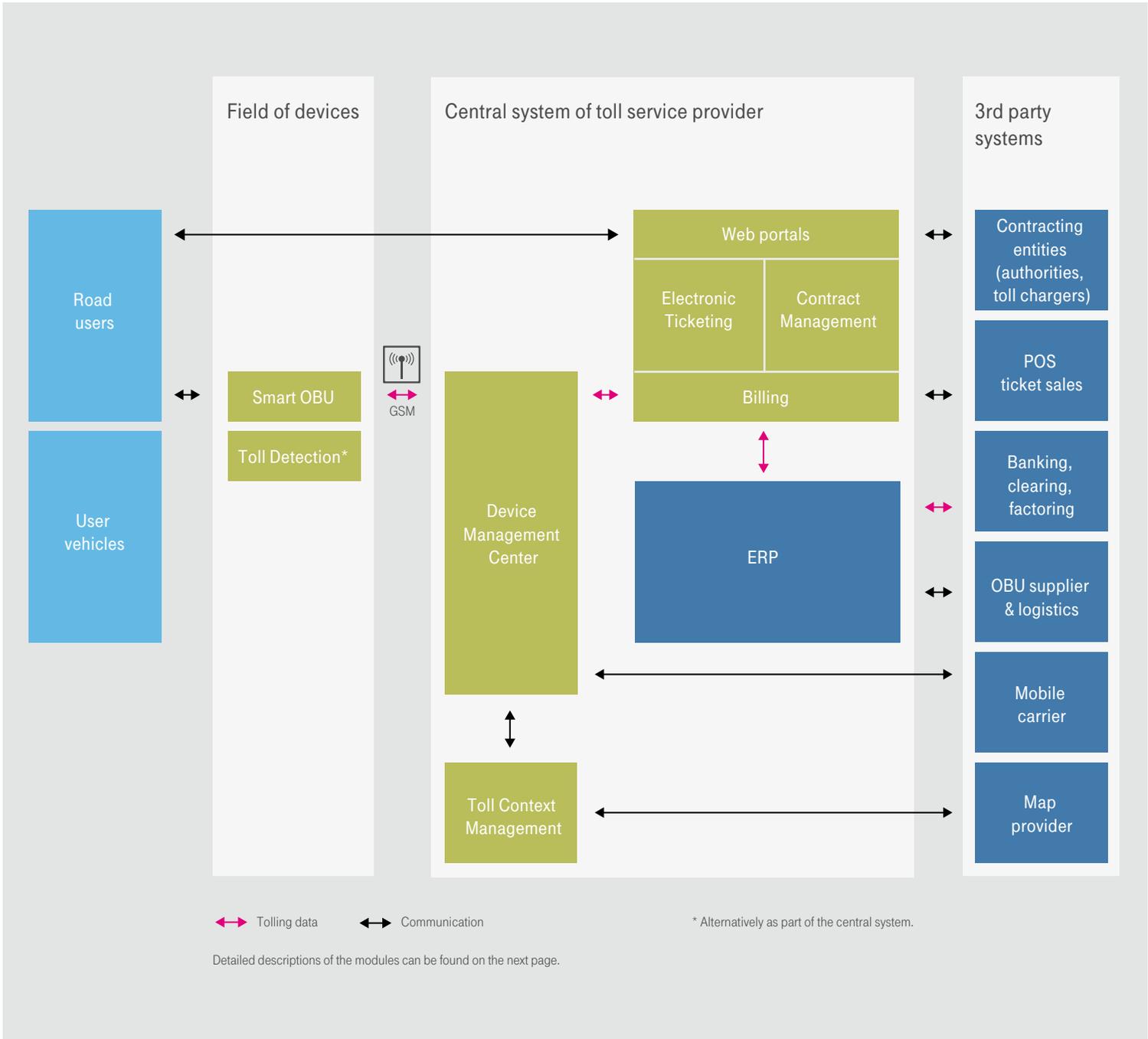
MAXIMUM EFFICIENCY AND FLEXIBILITY THANKS TO A MODULAR APPROACH

The Satellic Tolling Platform is designed to provide efficient support for business processes related to toll detection and calculation, customer service and billing – by means of a modular solution design.

The diagram does not portray a complete TSP system landscape, but rather focuses on the core components as provided by Satellic TP. TSPs also benefit from the extensive experience offered by T-Systems, and made-to-measure services for the design, implementation, integration and operation of additional systems – such as systems for compliance checking (enforcement), service network management, monitoring, reporting and surveillance, management information and business intelligence.

CORE COMPONENTS OF THE SATELLIC TOLLING PLATFORM

Field of devices

Central system of toll service provider

3rd party systems

Road users

User vehicles

GSM

Smart OBU

Toll Detection*

Device Management Center

Toll Context Management

Web portals

Electronic Ticketing

Contract Management

Billing

ERP

Contracting entities (authorities, toll chargers)

POS ticket sales

Banking, clearing, factoring

OBU supplier & logistics

Mobile carrier

Map provider

↔ Tolling data ↔ Communication * Alternatively as part of the central system.

Detailed descriptions of the modules can be found on the next page.

SATELLIC TOLLING PLATFORM: CORE COMPONENTS

SATELLIC SMART OBU

An on-board unit (OBU) is a device which is mounted in a vehicle and auto-matically detects toll roads. Our specific software environment for OBUs enables secure and reliable remote management of devices in the field, plus excellent GNSS and map-based autonomous toll detection. The smart OBU approach provides exceptional user transparency and data privacy, reducing user complaints and, as a result, operating costs.

The OBU software environment provides a platform for TSP-specific value-added services, such as tracking and tracing, insurance applications and logistics and fleet management functionality. In conjunction with selected hardware partners, we offer an integrated software and hardware solution that can easily be adapted to customer-specific needs.

SATELLIC DEVICE MANAGEMENT

One of the most challenging tasks for toll service providers is the operation of a large number of active OBUs mounted in vehicles. Robust OBU software/hardware design backed by effective remote management is essential, to avoid expensive recalls. Other core operational requirements

are the optimization of communication costs, and the maintenance and documentation of valid configurations for each device, in case of software or operational data changes.

T-Systems Satellic Telematic Services offers a device management system that fulfils all these needs. Additionally, the system offers important reporting and operational functions such as the management of device groups, various software versions, mixed hardware fields and much more.

SATELLIC TOLL CONTEXT MANAGEMENT

In addition to managing the OBU field, toll service providers need to maintain a high-quality set of charging rules, which are mainly determined by the definition of toll objects (e.g. street sections, city zones, bridges, tunnels, etc.) and related tariff sets.

Satellic Toll Data Management supports the integrated management of geo objects, toll objects and tariffs for multiple toll domains (such as toll chargers with individual tariff schemes). The system also allows version-controlled management of all data, and supports all relevant standards for quality assurance and documentation when toll data modifications are performed.
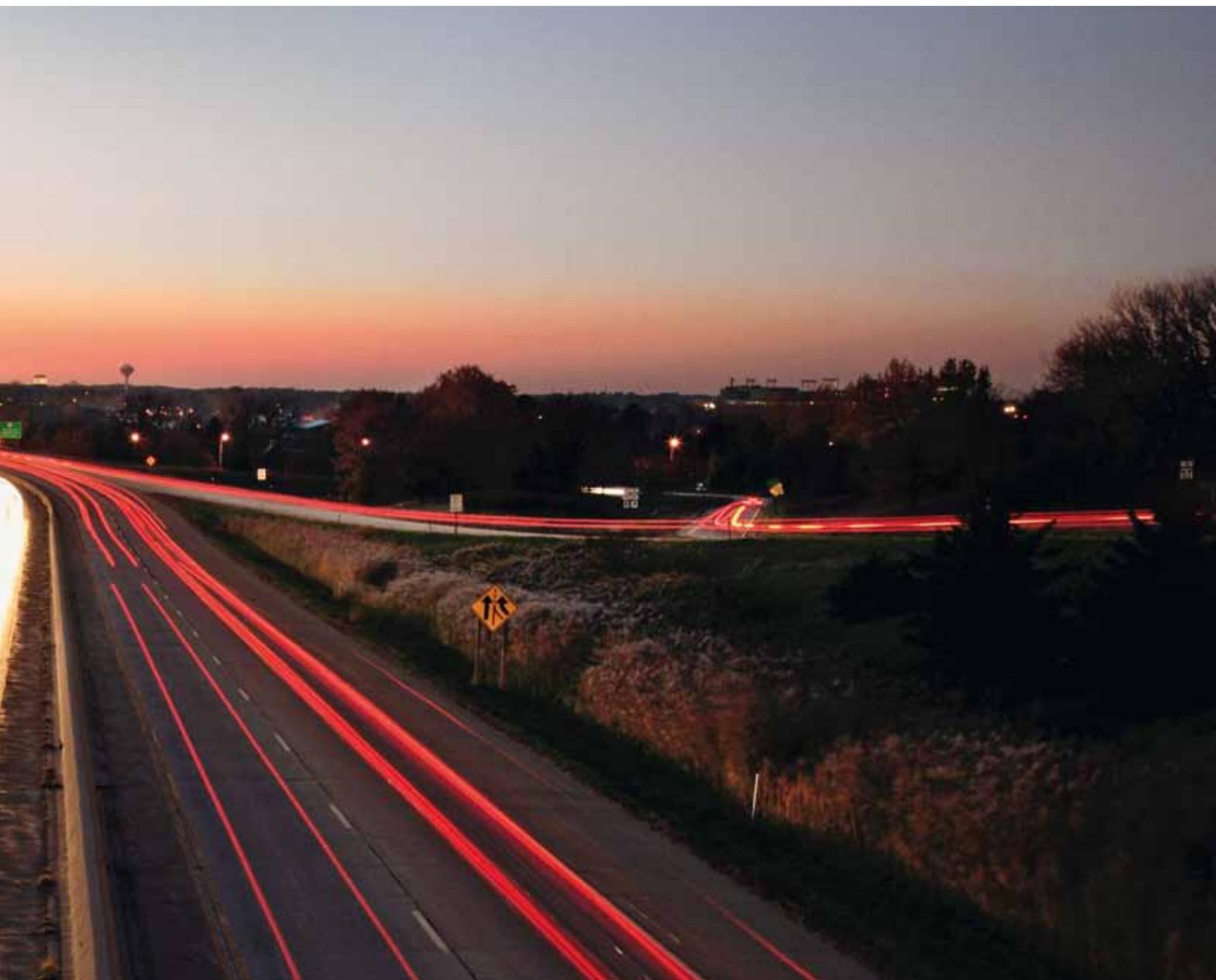
SATELLIC CONTRACT MANAGEMENT AND BILLING

The management of end-customer relationships is one of the main value-chain elements expected from a TSP. The Satellic Tolling Platform offers an integrated module for contract management, billing and web portals, specifically tailored to manage all business entities and customer processes related to road user charging. This includes management of user and vehicle master data, OBU management and pairing, (value-added) service management, pre- and post-payment options, and much more besides. Because standard software is used for the application platform, it is easy to seamlessly integrate TSP-specific enhancements and processes, and to add value-added services.

A web portal for road users features a state-of-the-art UI and reduces customer service costs (agents, mailings, etc.). A second web portal for TSPs offers a business dashboard with all necessary operational and commercial functionality – generating performance reports for external contracting entities, for example. The system can be readily integrated with the Satellic Device Management and Toll Detection system. But it can also be used with other (additional) data sources such as billing data records from toll chargers in EETS environments, value-added services, and so on.

Satellic Contract Management and Billing can be integrated with a standard ERP system for certified accounting in line with the TSP's implementation policy (whether integrating ERP with all other business functions, or implementing it as stand-alone system for user and road charge accounting).

SATELLIC ELECTRONIC TICKETING

The Satellic Contract Management and Billing system is complemented by an electronic ticketing system. This is specifically designed for road user charging scenarios such as backup systems for GNSS-based tolling schemes (foreign and occasional users, broken OBUs, etc.) or as a stand-alone system in booking models (i.e. for city tolling, etc.). The Satellic Electronic Ticketing application maintains a white list of all valid or cancelled bookings and provides these to enforcement systems. It also delivers access options for registered and non-registered users, as well as web portals optimized for high-resolution (desktop/laptop/tablet), hardware and mobile devices.
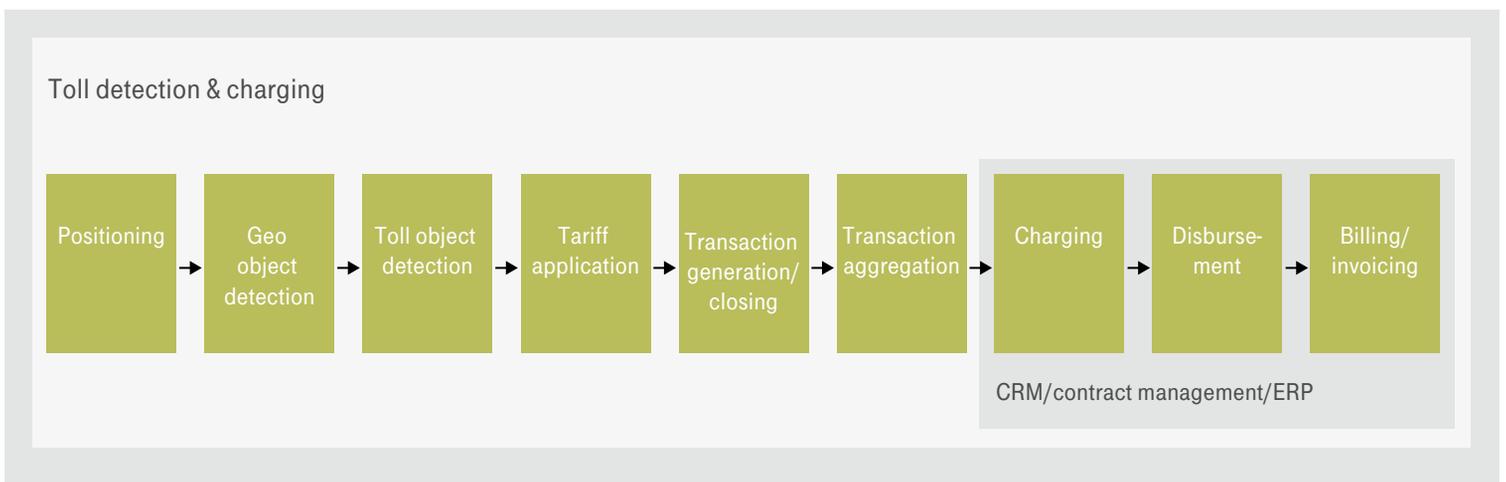
SMART OBUS FOR HIGHEST POSSIBLE DATA PRIVACY

T-Systems has created the Satellic Tolling Platform to provide maximum robustness and highly effective detection. But it is also designed to comply with existing and potential future European data privacy standards.
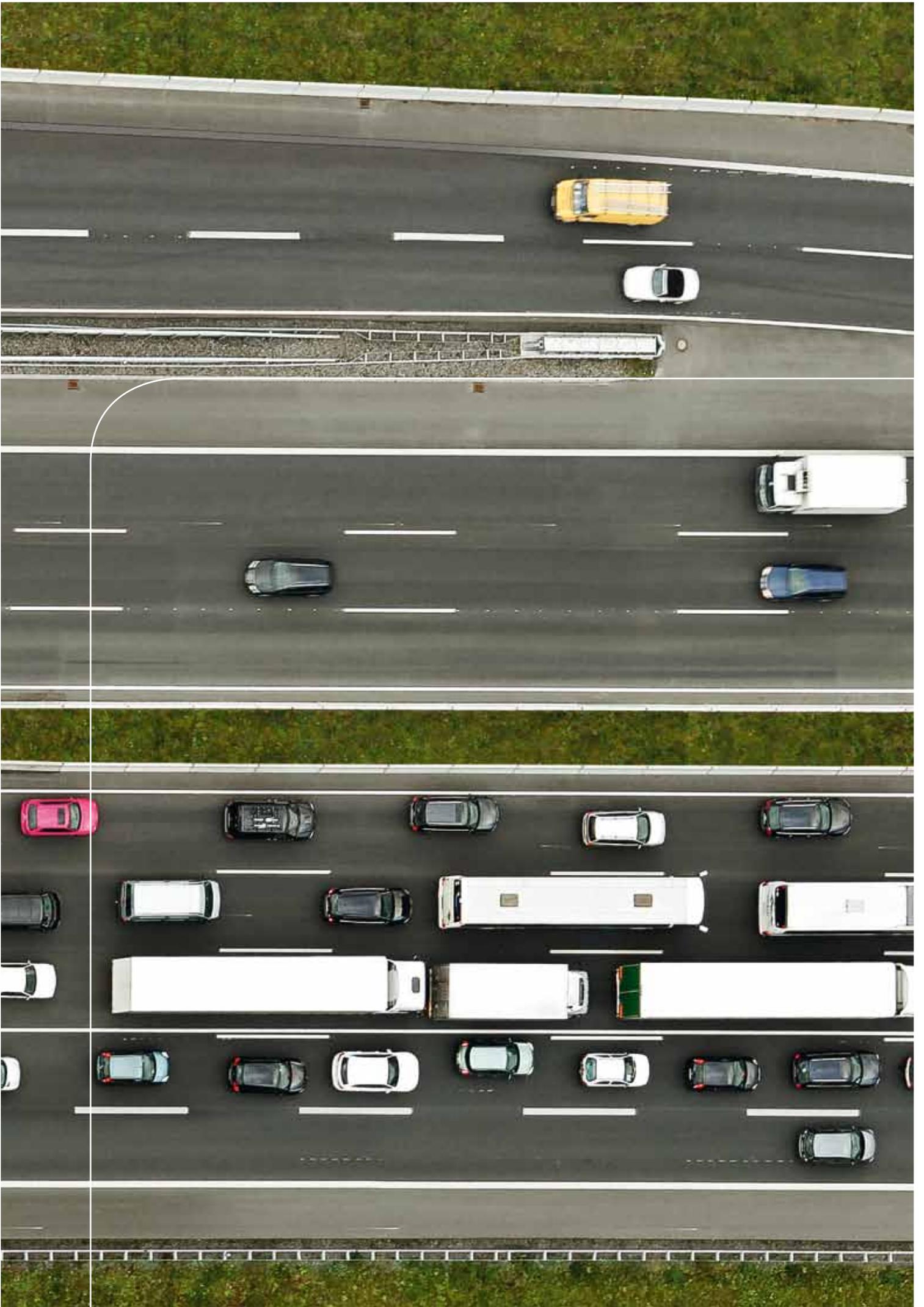
In today's increasingly information-based society, privacy is already one of the most critical features affecting consumer decisions, acceptance and cooperation. Its importance will certainly continue to grow in the future. TSPs are directly affected by this, given that vehicle positions and routes of vehicles are regarded as personal data.

One of the main objectives of EU Directive 95/ 46 is to reduce the use of personal data and, accordingly, to encourage the design of business processes that require only a minimum of sensitive data. In other words, the sensitivity of the data used should decrease along the processing chain: only information that is actually necessary for the relevant financial transaction is passed on. The design philosophy of the T-Systems platform reflects this: only the data needed for further processing leaves the OBU. Other steps, including the aggregation of tolling events, are performed on the OBU. Users have complete transparency, as they have access to detailed data on their OBU and can opt-in to transfer journey data – in case an in-depth journey statement is required in addition to the invoice document.

SATELLIC TOLLING PLATFORM DATA PROCESSING CHAIN

Toll detection & charging

| Positioning | Geo object detection | Toll object detection | Tariff application | Transaction generation/ closing | Transaction aggregation | Charging | Disburse-ment | Billing/ invoicing |

CRM/contract management/ERP

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