

Solutions Toll & Road Pricing

Improving efficiency and reducing costs



ELECTRONIC
TOLL COLLECTION

 SKYTOLL

Toll & Road Pricing

Toll & road pricing is the practice of charging drivers a fee for using specific roads or highways. This fee is intended to cover the costs of road maintenance, construction, and other infrastructure-related expenses. Toll & road pricing can take various forms and is often implemented to manage traffic congestion, raise funds for transportation projects, and encourage more efficient use of road networks. The goal is to create a more sustainable and effective transportation system while also generating revenue to support ongoing infrastructure needs.

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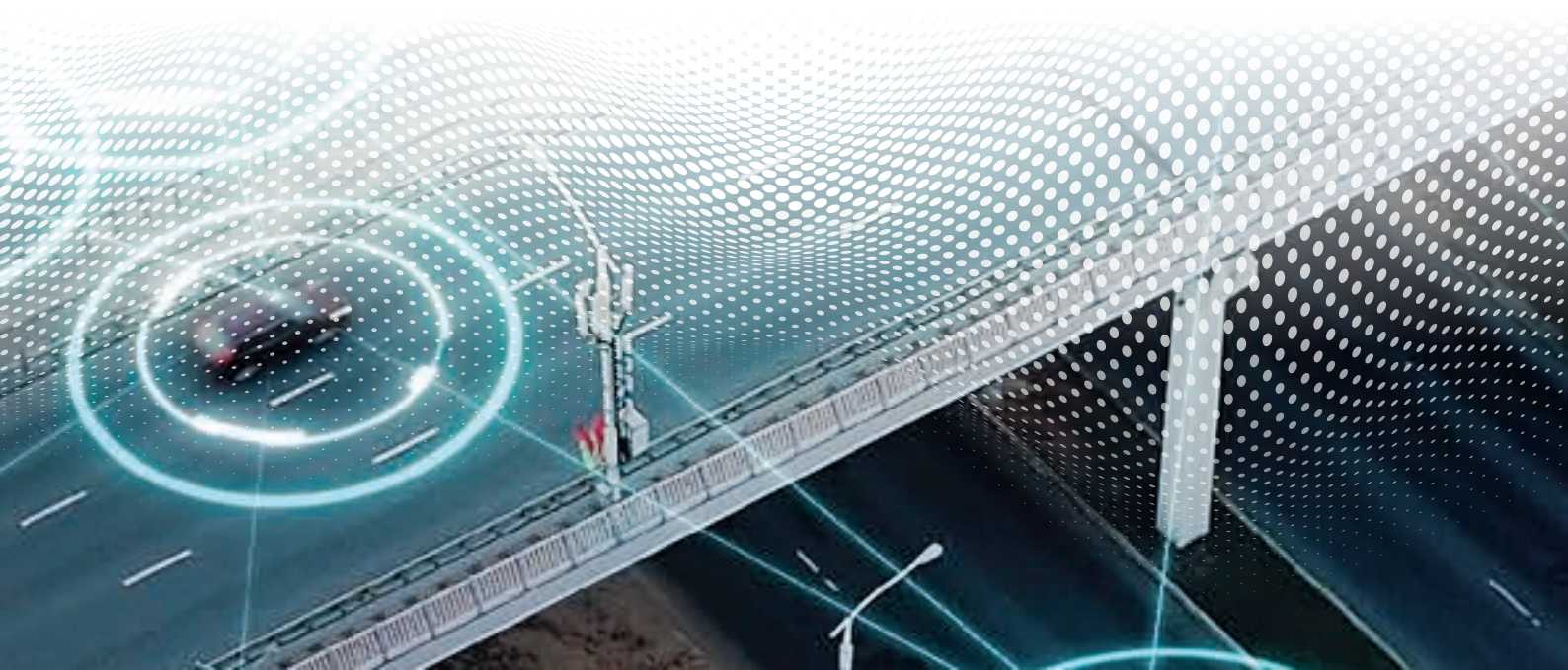


More information:
qrfy.com/p/2023_trc_p2

Solution:

Electronic Toll Collection

Electronic Toll Collection automates the process of collecting tolls on roads and bridges, allowing vehicles to use the transport infrastructure seamlessly, reducing congestion, and improving traffic flow.



Solution

Electronic Toll Collection

Electronic Toll Collection (ETC) is a smart solution for the collection of fees based on the use of various kinds of transportation infrastructure by all vehicles. ETC solutions need to be tailored for the specific requirements of the environment in which they are implemented, but they always have to be robust and reliable.



Electronic Toll Collection, often referred to as Electronic Road Pricing (ERP), is a solution for automated toll collection on roads, bridges, and tunnels. It allows the collection of tolls without the need to stop the vehicle, slow down or use a specific lane. The Multi Lane Free Flow (MLFF) allows drivers to use tolled infrastructure seamlessly and efficiently. ETC solutions use a combination of technologies such as global navigation satellite systems (GNSS), automatic number plate recognition (ANPR), microwave (DSRC) or radio (RFID) communication, to identify vehicles and deduct tolls by the payment method chosen by the road user.

The successful implementation of ETC requires careful planning, public consultation, and collaboration between government authorities, transportation agencies, and stakeholders. When designed and executed effectively, ETC is a valuable tool for creating more efficient, sustainable, and liveable environments.

Main advantages

- **Congestion reduction**

ETC can help alleviate traffic congestion as it functions in a multi-lane free-flow system and allows for adjustment of toll rates for busy areas and peak hours

- **Funding for infrastructure**

Road charging through ETC generates revenue that can be used to improve and maintain transportation infrastructure

- **Traffic management**

ETC solutions can provide valuable data on traffic volumes and patterns, allowing transportation authorities to make real-time, data-driven decisions to manage and optimise traffic

- **Promotion of sustainable transportation**

ETC can incentivise the use of greener transportation options like electric vehicles, public

transportation, or bicycles, as these options may be exempt from charges or charged lower rates

- **Equity and social benefits**

ETC can be designed to provide discounts or exemptions for low-income individuals or residents in specific areas to ensure fair access to transportation

- **Customisation and flexibility**

ETC systems can be easily adjusted to respond to changing traffic conditions, road maintenance, or special events, offering flexibility in the management of road charging schemes

- **Future-proofing**

As technology advances, ETC systems can adapt to incorporate emerging technologies, paving the way for more sophisticated road charging mechanisms

Key benefits for road users

- **Seamless travel experience**

ETC uses non-stop tolling to allow road users uninterrupted travel and reduced travel time, and to prevent waiting in toll queues

- **Faster commutes**

With ETC, road users experience quicker and smoother commutes as toll transactions are processed electronically to reduce congestion at toll plazas

- **Fuel savings**

Eliminating the need to stop at toll booths saves road users fuel costs and reduces environmental impact

- **Convenient payment**

ETC removes the need for cash payments and searching for loose change at toll booths. Users can prepay their toll fees or have their toll amounts deducted electronically to create a hassle-free payment process

- **No toll booth interaction**

Road users do not need to interact with toll booth operators, thereby

reducing the risk of human error in toll collection and delivering a contactless payment experience

- **Interoperability**

ETC systems have a level of interoperability that allows a single transponder or user account to be used across multiple toll roads and facilities. This makes it more convenient for travellers who frequently use different tolled roads

- **Improved safety**

ETC contributes to enhanced road safety by reducing potential traffic jams and congestion, which leads to a reduction in accidents in these areas



Leveraging our experience and expertise in the toll industry, we have created products that use different types of platforms and technologies for ETC and can be customised according to the specific needs of our customers.

Platforms

- Satellite-based electronic toll collection system (GNSS)
- Video-based electronic toll collection system (ANPR)
- DSRC-based electronic toll collection system
- RFID-based electronic toll collection system
- Time and distance-based ticketing (eTicket)
- Combination of technologies tailored to specific implementation (Hybrid)

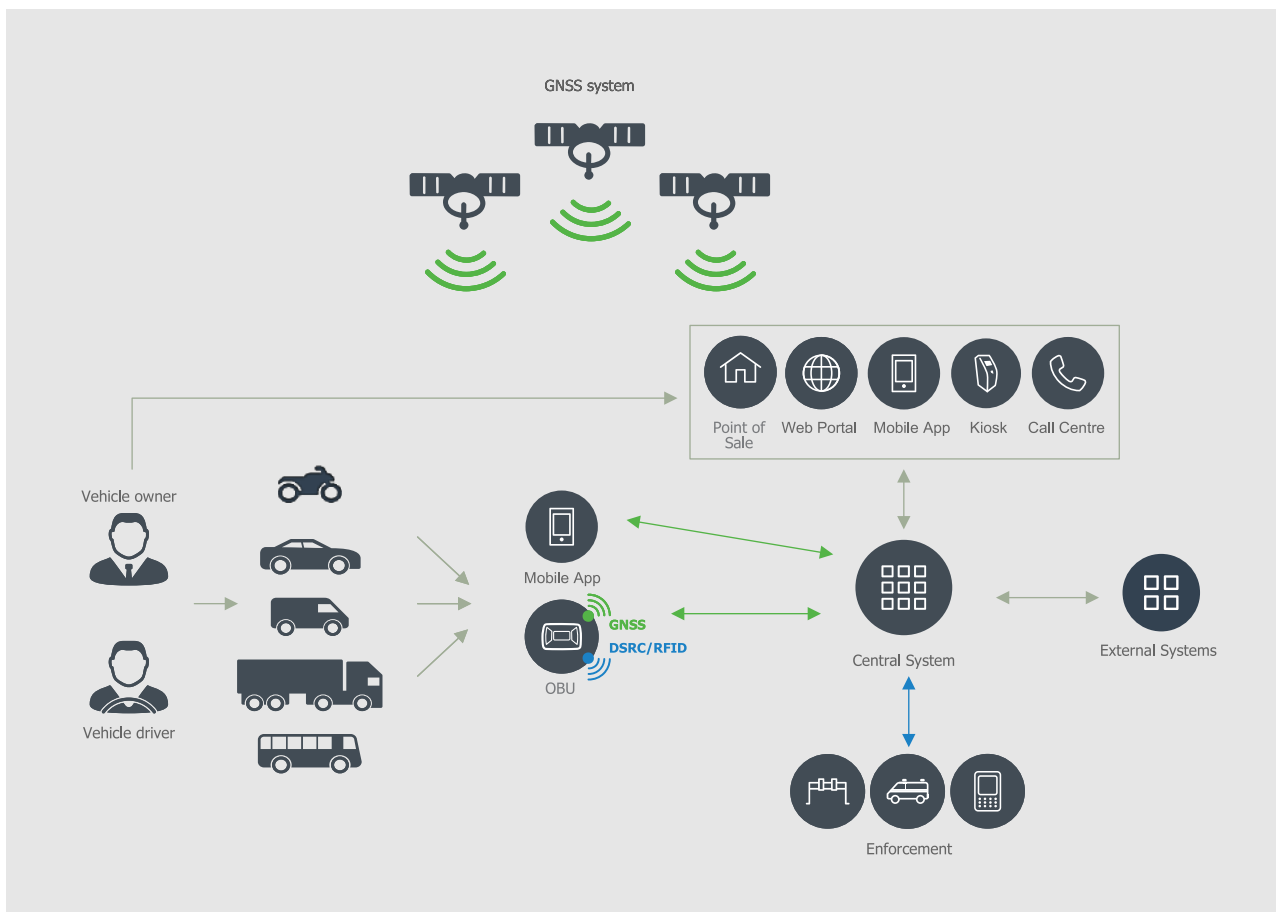


For each of our customers, we always create a unique personalised solution that takes into account the requirements, conditions, resources, and environment in which it is implemented. A particular solution may include a combination of several technologies, for example, the use of GNSS for trucks and ANPR for passenger vehicles, or even a combination of ETC and conventional tolling systems using toll booths. We are constantly innovating our products to keep them state-of-the-art, and we use new technologies like Artificial Intelligence to increase efficiency and effectiveness.

Platform

Satellite-Based Electronic Toll Collection (GNSS)

Satellite technology enables toll collection across multiple lanes of free flowing traffic without the need to change the speed or direction of the vehicles. GNSS tolling provides flexibility for the implementation of new system extensions, allowing it to keep pace with changing requirements without the need for the construction of costly new infrastructure.



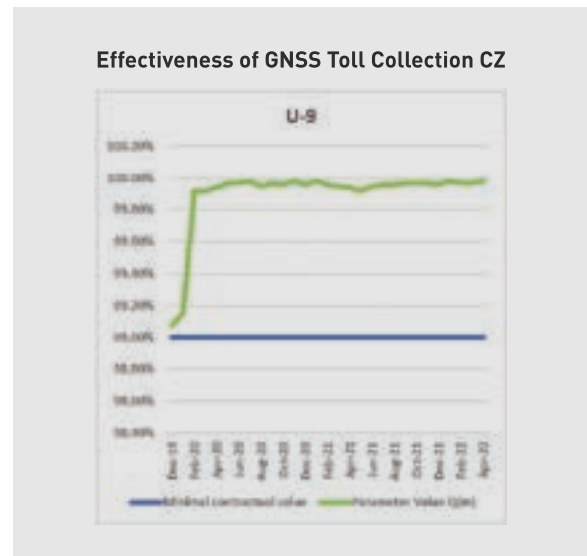
More information:
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GNSS tolling, or Global Navigation Satellite System tolling, is a technology that utilises satellite positioning to collect tolls from vehicles based on their geographic location. It enables precise, automated toll collection by accurately determining a vehicle's position and calculating toll charges accordingly.

This solution does not require the construction of toll gantries or toll plazas, so saves on time, costs and resources associated with a non-satellite-based tolling system.

Satellite-based tolling systems provide flexibility when changing the range of a toll road network by speeding up the process and removing the need for expensive and time-consuming roadside technology. Satellite-based tolling is particularly effective in countries where the development of new toll roads is planned.

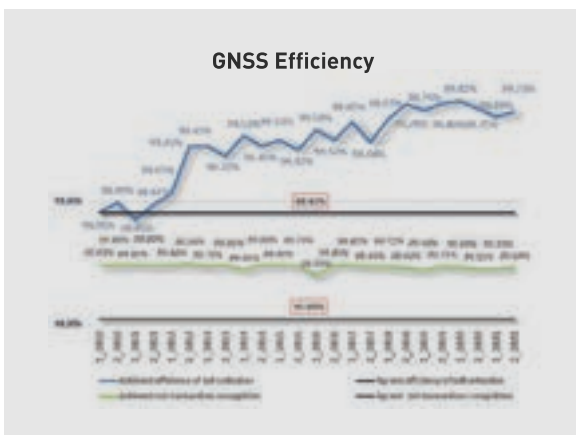
GNSS tolling is based on cutting-edge, reliable and future-oriented technologies.



Key benefits

- **Efficient toll collection**
- **Non-discriminatory and quick access** for road users meets the terms and conditions for use of the toll road network
- **Permanent, error-free, continuous operation** of tolling infrastructure and systems increases comfort for users of the toll road network
- **Low investment and operating costs**
- **Cost and time-efficient** implementation of legislative changes related to toll roads
- **Efficient generation** of revenue from toll collection

Following the effective integration of the satellite-based tolling solution, additional advantages can be unlocked through a range of value-added services like real-time traffic updates, automatic emergency notifications, and usage-based car insurance. GNSS tolling introduces flexibility to defining toll rates based on several parameters and combinations.



When using GNSS, every vehicle liable for toll payment is required to be equipped with an On-Board Unit (OBU) or mobile app before entering the toll road network. The installation of the OBU is simple and can be performed by vehicle drivers.

From a technical viewpoint the GNSS tolling is technologically complex, consisting of several information subsystems and specific applications. They ensure the operational processes of toll collection and allow easy integration with external systems. The solution can be easily adapted to national legislation concerning toll collection.

Parameters for flexible tolling

- Road type (highway, motorway, lower road classes)
- Vehicle category (the combination of vehicle type and vehicle weight)
- Vehicle emissions class (such as EURO emissions classes)
- Number of axles
- CO2 emissions
- Noise level (e.g. for night and day)
- Season, month, day of the week, hours during a day
- Current traffic intensity
- Current traffic speed

Components

- **Central Information System**

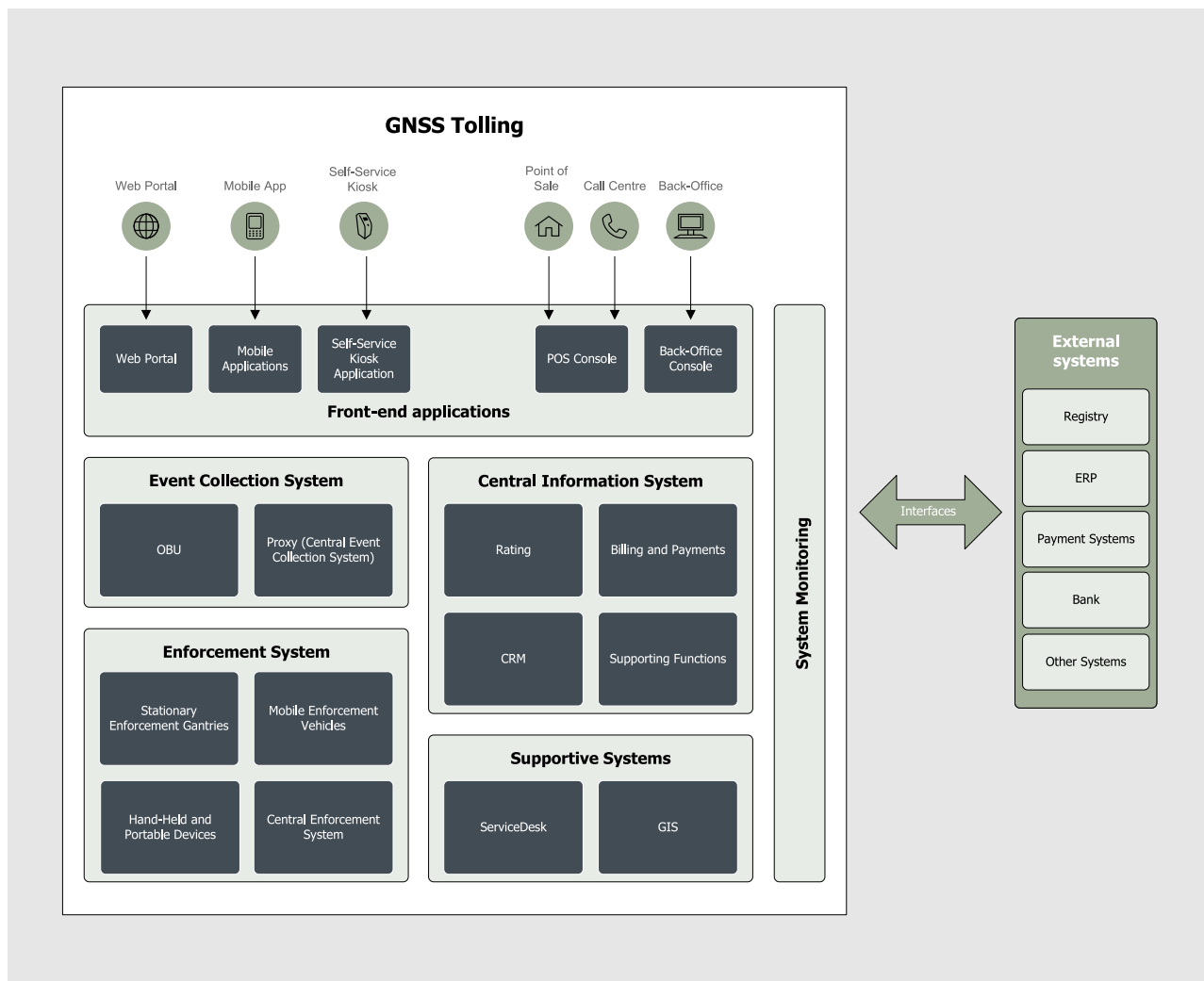
A complex IS supporting all business activities of an electronic toll collection company (customer care, billing, payments processing, etc.)

- **Event Collection System**

System made up of OBU (OBU device or mobile app) and Proxy safeguards data about toll road usage and delivery of data to the CIS

- **Enforcement System**

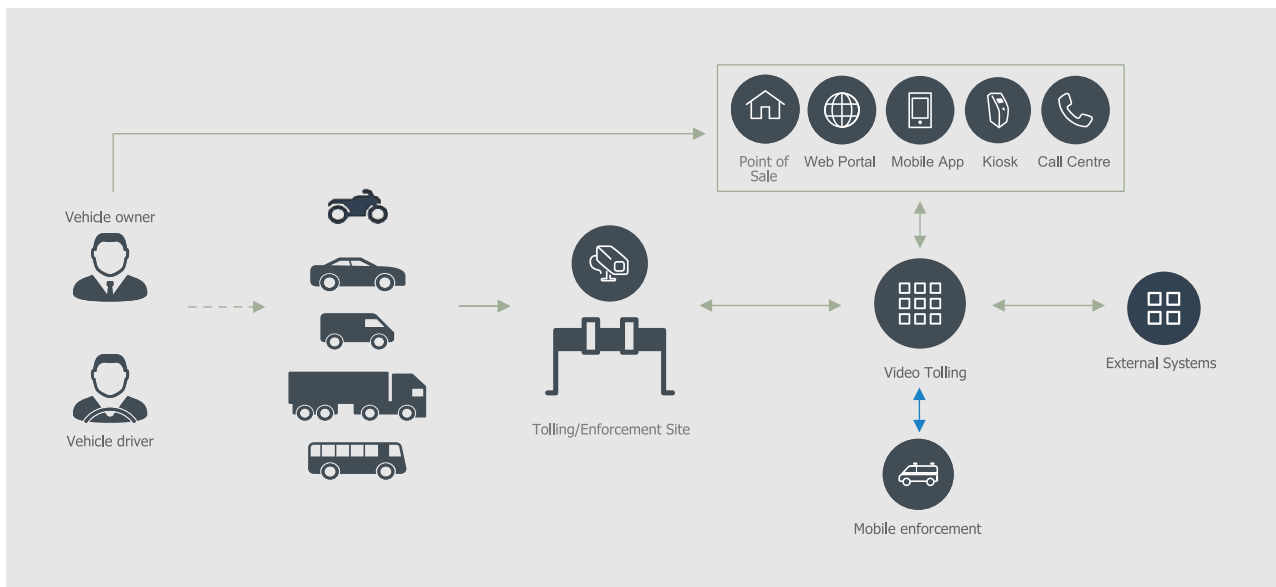
Verifies compliance by vehicle owners and drivers with electronic monitoring obligations and identifies non-compliance



Platform

Video-Based Electronic Toll Collection (ANPR)

A great advantage of our Video Tolling System lies in the fact there is no burden on vehicle owners. The Video Tolling System does not require any vignettes, electronic tags, or on-board units to be installed in the vehicle, removing the need for complex logistical operations and high financial costs.



Our Video-based Electronic Toll Collection System is a flexible, state-of-the-art solution for free flow toll collection using video technology. It relies on cameras and AI algorithms to identify and record vehicles passing through designated tolling points. A Video Tolling System offers several benefits over traditional tolling methods.



More information:
qrfy.com/p/2023_trc_p12

Key benefits

- **Elimination of the need for physical toll booths** results in reduced congestion and improved traffic flow
- **Increased accuracy and efficiency in toll collection** minimises errors and the need for manual intervention
- **Convenience for drivers** by enabling seamless, contactless payments and reducing the need to stop or slow down at toll plazas

Our Video Tolling System is able to process large amounts of data at a time. Automatic Number Plate Recognition (ANPR) interacts with all models of vehicles, ranging from motorbikes to heavy goods vehicles. This makes it a suitable solution for a wide range of environments, including busy urban freeways, country-spanning highways, high-density expressways and car parks.

The cameras are equipped with advanced optical character recognition (OCR) technology that can read license plates and extract relevant vehicle information. The Video Tolling

System can be customised for each of the toll modes in regard to the manner of collecting toll data. It is also possible to implement a combination of those modes together.

Modes

- **Open Mode**

Is used to charge vehicles for entry into the toll section. This mode has a wide range of applications, spanning from toll bridges and tunnels to isolated zones, such as rest areas. Open Mode is cost effective and fit for use on long-spanning roads such as highways and expressways. Its use requires only a singular gantry at every toll section entrance.

- **Closed Mode**

Entry and exit to the tolled area are recorded and the toll is calculated based on the distance a vehicle travels between those two points. Closed mode can be used for charging for passages through cities or closed areas, where it is possible to reliably monitor all entry and exit points, such as paid parking lots. Due to the nature of this mode, it is also possible to reliably detect the amount of time a vehicle spends in the area and then link the data to the relevant toll event.

Once the vehicle is identified, the central system calculates the appropriate toll based on factors such as distance travelled, vehicle category, and any applicable discounts or fees. The system allows for full customisation of the way vehicle passage data are rated, and are tailored specifically to the needs of the toll operator. Instead of calculating tolls based solely on vehicle data, the toll operator can opt in to apply additional factors. These range from the current season all the way to a particular hour of the day or type of road. Toll operators can use these settings to influence traffic flow within an area, to prevent drivers from avoiding higher tolls and to lower congestion.

Toll charges calculated using gathered data can be paid by several payment methods and payment regimes. The main supported regimes are Post-Pay Mode and Pre-Pay, which differ mainly in method and frequency.

In addition to the flexibility of the system, many different sales and communication channels can be included. Popular options include smartphone applications, kiosks, or online self-care portals. Points of sale and call centres where vehicle owners can personally interface

with the system can also be used. This makes the system accessible to all kinds of vehicle owners who wish to stay informed about their toll transactions.

Checking compliance with toll obligations is performed by the enforcement feature of the central system and is based on data relating to real usage of tolled roads captured by cameras and mobile enforcement vehicles.

The architecture of the Video Tolling System also allows for monitoring of traffic density or, from a long-term perspective, calculation of traffic trends once enough data has been collected. This data can be utilised for evaluating traffic trends and creating accurate predictions for future traffic patterns. These predictions can assist in future infrastructure development and with the implementation of future changes to toll rates, allowing the entire toll system to evolve solely within itself without the need for additional external software.

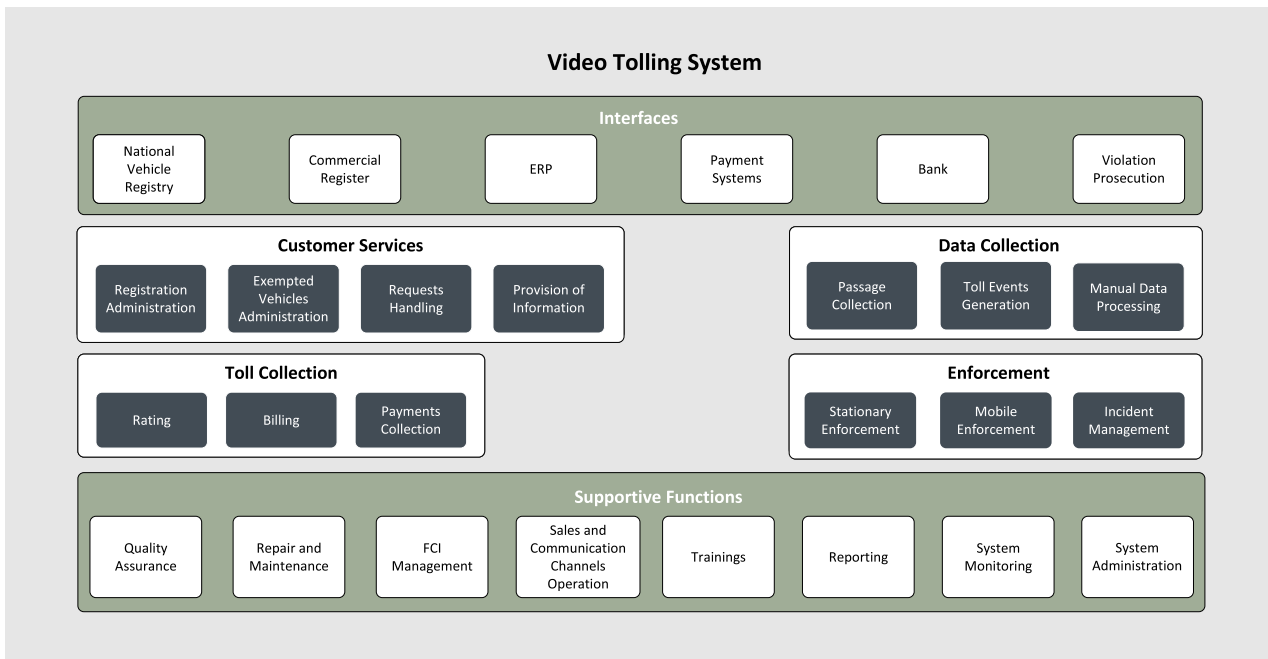
The Video Tolling System can operate through a datacentre or the cloud, which is effective and flexible and provides a solution with an almost unlimited computing power and data storage.

Despite the versatility and wide scope of possible applications, the system remains accessible to toll operators as well as commuters and travellers. Although it is complex and sophisticated, the deployment and operation of this Video Tolling System can be carried out cost effectively without any impact on accuracy or reliability.

Overall, Video Tolling Systems streamline the toll collection process, improve traffic management and enhance the overall driving experience for commuters and travellers alike.

Components

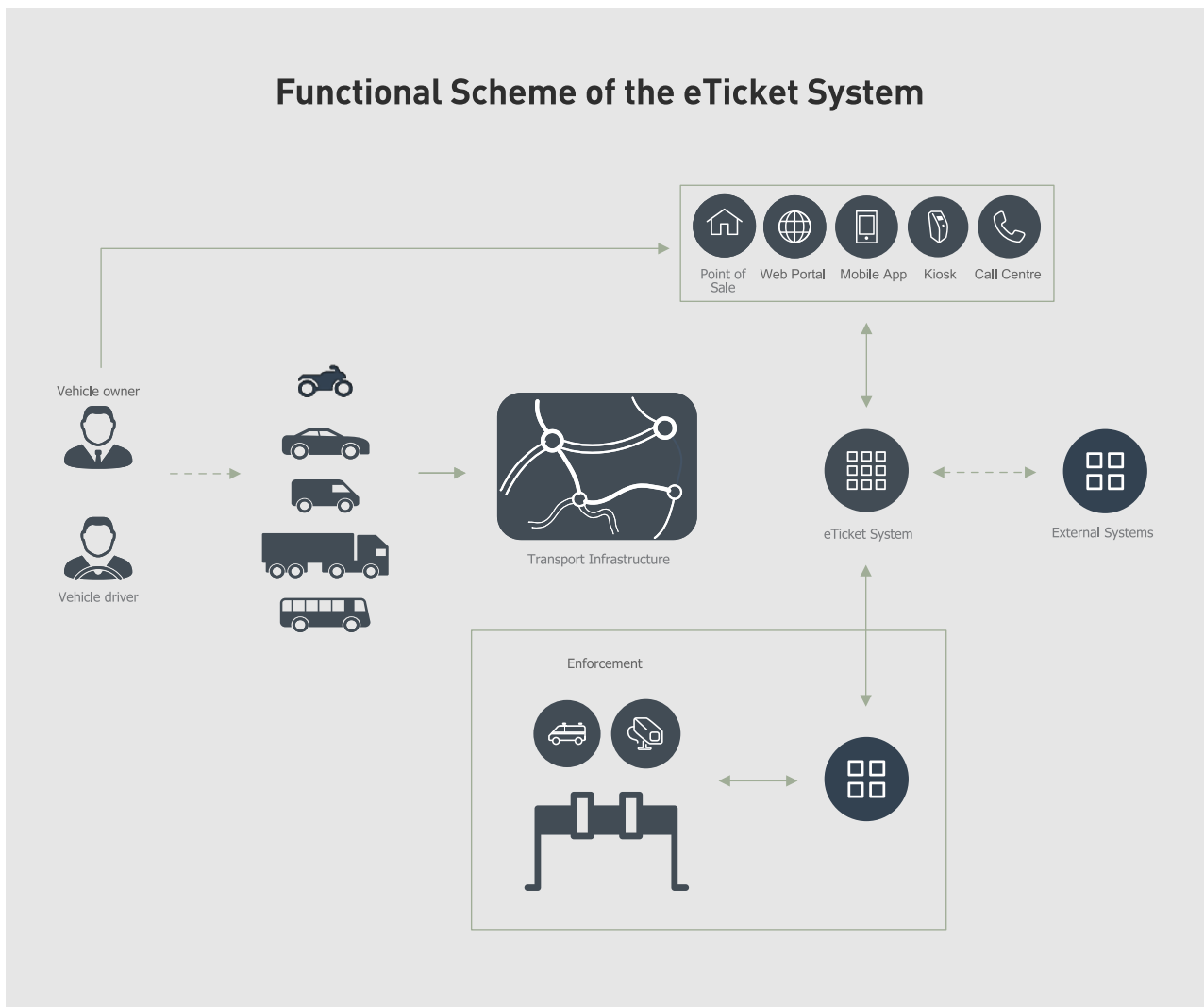
- Strategically placed **stationary gantries** that hoist cameras, to capture images and/or videos of vehicles as they enter and exit tolling zones
- **Central system** that processes data from cameras, matches it with the vehicles registered in the system, and calculates and collects toll fees as well as evaluating violations
- Sales and communication channels for providing customer services
- **Mobile enforcement vehicles** that evaluate toll violations within the toll area



Platform

eTicket System

eTicket is a free flow system for electronic toll collection that enables charging for the use of transport infrastructure on the principle of time or route, as well as a combination of vehicle categories without having to stop or slow down a vehicle.



More information:
qrfy.com/p/2023_trc_p16

eTicket is used to charge toll fees for the use of transport infrastructure without the need to install vehicles with an additional device or tag. This removes the financial burden from both the customer and the service provider, making the system more affordable. Paired with its flexibility, eTicket can be a seamless option for long-distance travel as well as short local routes thanks to its architecture being designed to process large amounts of data.

Suitable for different kinds of transport infrastructure:

- Roads
- Parking lots
- Bridges
- Tunnels

The price list for the eTicket service is configurable at the road operator's request. eTicket enables charging for transport infrastructure on the basis of time or route, or a combination of both.

eTicket excels at charging for using motorways and expressways, and can replace the popular "motorway vignettes" used by many countries.

In this case, our eTicket system replaces the motorway vignette sticker with an electronic customer account. It benefits road users as they do not have to scrape old vignettes from the window to replace them, and provides additional benefits for road operators.

Main benefits

- **Cost savings** on the procurement and logistics of vignettes stickers
- **Low initial investment** and operating costs
- **Immediate availability** (never out of stock)
- **Flexible for future changes**
- **Better enforcement capabilities** and efficiency

Buying an eTicket is simple and understandable for the customer. They can purchase through various sales and communication channels.

eTicket types

- **Time eTicket**

(on the principle of time) eTicket authorises the vehicle to use the relevant transport infrastructure for the period of the eTicket's validity. Alongside providing the vehicle license plate number, the customer must also provide the vehicle category and the start date of the eTicket.

- **Kilometre eTicket.**

(on the principle of a route) eTicket authorises the vehicle to travel on a specified route. Routes can be precisely defined in advance, or be determined by the customer during the purchase of the eTicket. The customer determines the route by entering a start and end point and can specify the route by entering several waypoints. In addition to the vehicle parameters, the price of the eTicket in this case also depends on the length of the route.

Sales and communication channels

- **Web portal**
- **Mobile app**
- **Point of Sale**
- **Self-service kiosk**
- **Call centre**

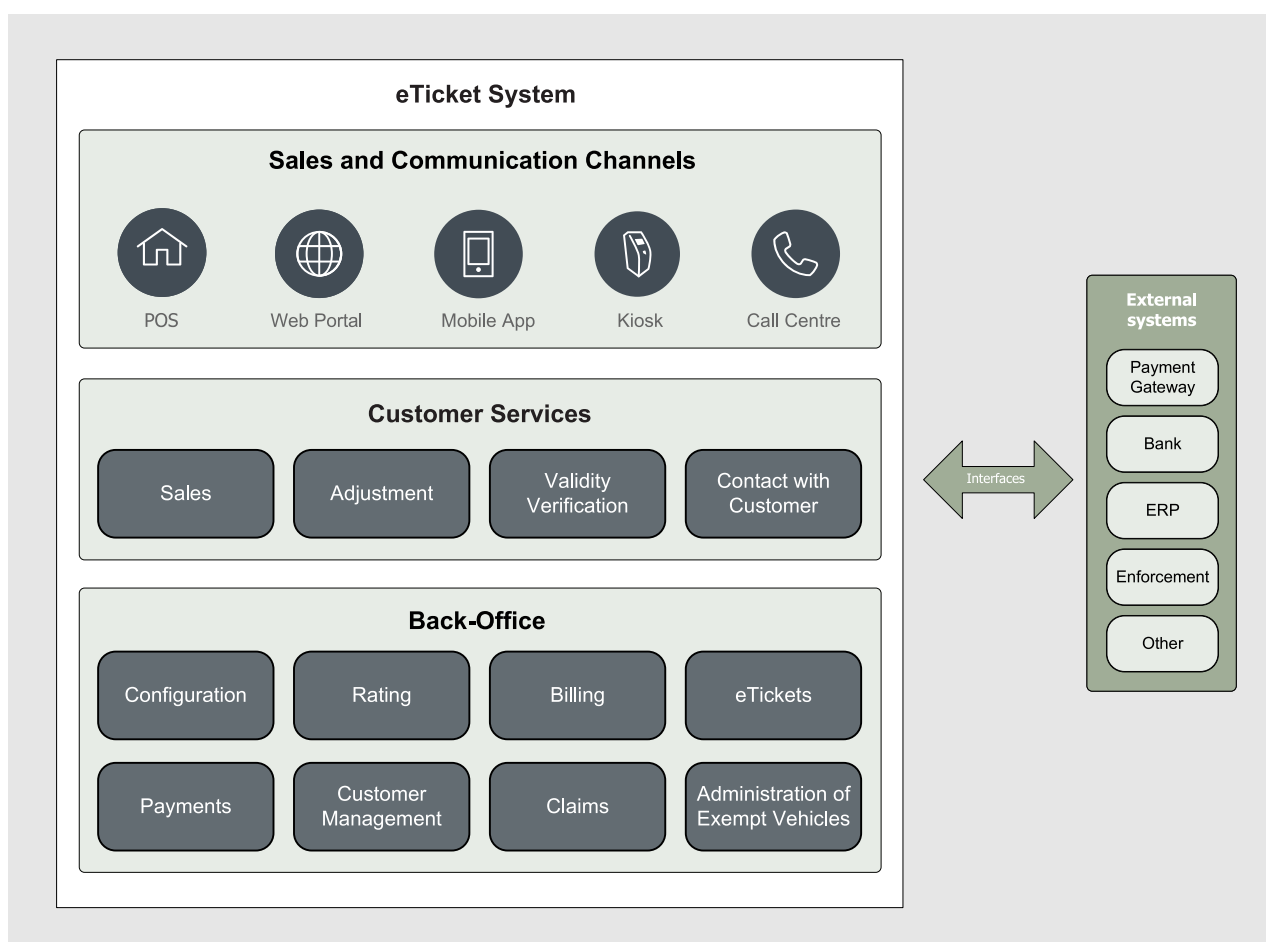
To maintain and develop the relationship with road users, the eTicket system offers several offline and online services where they can submit claims and inquiries. Customer services cover the key functionalities of the eTicket system and are performed through the same sales and communication channels as during the eTicket purchase.



When designing the eTicket system, we made our main focus convenience. Should there be any reason to change data in the system, whether due to an incorrect input or the information changing, the road user can conveniently make changes through the web portal or call centre, or they can visit one of the points of sale. To increase the comfort of customer services and service capacity, the self-service kiosk can be used.

Key domains

- Sales and communication channels
- Customer service
- Back office



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