

Kapsch TrafficCom

***The JuztDrive Proof
of Concept –
by Kapsch TrafficCom
and Aventi Intelligent
Communication***

Overview

Road user charging – a proof of concept

What Is Road User Charging

Road user charging and vehicle miles travelled are charges based on true distance driven and are introduced as a replacement for existing fuel/gas taxes.

Currently, all state and/or national/federal governments around the world tax the retail sale of petrol, diesel and gasoline. In most cases, for each €1 or \$1 of fuel a driver buys at the pump between 20% - 70% (depending on the country) is tax.

The sum of these taxes contributes an average of 5% of a country's national budget. Technically, these taxes should contribute directly towards the building and maintenance of all public roads and related infrastructure. In reality, the sum is often added to the overall state or national budget in the same way as income taxes and VAT etc.

As the number of electric and alternative fuel vehicles sold increases, governments all over the world face a reduction in the amount of fuel related taxes generated. In order to compensate, governments must either raise other unrelated taxes, such as income tax, or create a replacement which also serves the purpose of fairly and equitably taxing electric and alternative fuel vehicles for their use of the public road network.

Kapsch TrafficCom has the experience and technology required to design, develop, implement and operate nationwide road user charging systems that can balance the need for generating tax revenue for authorities with the need for fairness and accessibility for citizens.

The Kapsch/Aventi Proof of Concept

In June 2022, Kapsch TrafficCom together with its local partner Aventi Intelligent Communication started a Proof of Concept (PoC) for road user charging (RUC) in Norway.

Based on a smartphone app and proprietary server application developed by Aventi, Kapsch TrafficCom is using a thin client approach, matching the data provided by the app with its proprietary Geo Location Platform (GLP).

The goal of the PoC was to test whether the combination of an existing application – operating on dozens of different smartphones and tablets – and separate rating engine could deliver a high performance road user charging solution.

In total, more than 2 million kilometers of trips were processed as part of the PoC, delivering valuable insights to Kapsch TrafficCom and Aventi Intelligent Communication.

The system was able to handle the challenging environments of the Norwegian road network, matching routes and calculating rates with an accuracy level above 99%.



Overview

Tax revenues are decreasing quickly, making action necessary

Decreasing tax revenues

In Fall of 2022, the share of electric vehicles in Norway stood at 18.9%¹, the largest share in Europe. Almost all newly registered vehicles in Norway are electric, and by 2025, all new passenger vehicles have to be zero-emission, which means that in a few years, the majority of passenger cars on Norwegian roads will be electric.

The reason for this growing market share can be found in the strong subsidies that the Norwegian authorities have placed on electric vehicles with the ultimate goal of reducing CO2 emissions.

While that goal is being achieved, an obvious side effect is the rapid decrease of vehicle-based tax revenue (road use taxes, CO2 taxes, circulation taxes, registration fees, tolls) – from 11% of total government consumption in 2012 to 7% in 2018.

Additionally, as the number of electric vehicles is only set to increase, particularly fuel tax revenues will decrease even further in the coming decades, with the Norwegian Public Roads Administration (NPRA) estimating a decrease of more than 85% by 2050.



Government response

Anticipating the growing gap in funding, the Norwegian Parliament launched a proposal to study the potential for road pricing to replace road tolls in 2018, with a subsequent parliamentary decision to conduct a study in 2019.

In 2021, the Ministry of Finance and the Department of Transportation have commissioned the Norwegian Tax Administration and the NPRA to carry out a “concept selection study” regarding the principles of determining and collecting road user charges and tolls.

The goal is to ensure accurate and sustainable pricing of road use and financing of transport projects based on the “polluter pays” principle. This means that the societal costs of all road-based traffic (accidents, congestions, noise, road wear and health and environmentally harmful emissions) need to be considered in the payments road users are facing.

However, as societal costs are different between various types of vehicles, time of day and also location (urban vs rural), a fair system needs to take these factors into account and provide levers to adapt rates accordingly.

With the concept selection study being concluded by May 1st, 2023, the Norwegian Cabinet will make a decision on an approach that will be followed by a pre-project, Parliament approval and then finally project implementation.

1: <https://elbil.no/om-elbil/elbilstatistikk/elbilbestand/>

The JutztDrive Proof of Concept

Overview and principles

PoC Overview

Based on the experience gathered in the GNSS-based nationwide tolling project in Bulgaria that Kapsch TrafficCom designed, developed and implemented, the company partnered with local ITS provider Aventi Intelligent Communication to conduct a road user charging Proof of Concept (PoC) as part of the concept selection study.

The PoC, titled JutztDrive, was developed and began rollout in July 2022, focusing on vehicles in the greater Oslo area. It was based on a hardware-agnostic android application utilizing a centralized matching and rating 'thin client' model.

A mixture of approximately 30 real world and 30,000 simulated vehicles were captured with the system, each providing positions that were processed by the proprietary Kapsch Geo Location Platform (GLP) and used as a calculation basis for a road usage charge.

The goal of the PoC was to test whether the combination of an existing application – operating on dozens of different smartphones and tablets – and separate rating engine could deliver a high performance road user charging solution.

As each road network is a unique living entity, the goal was also to test a series of challenging conditions specific for Norway.

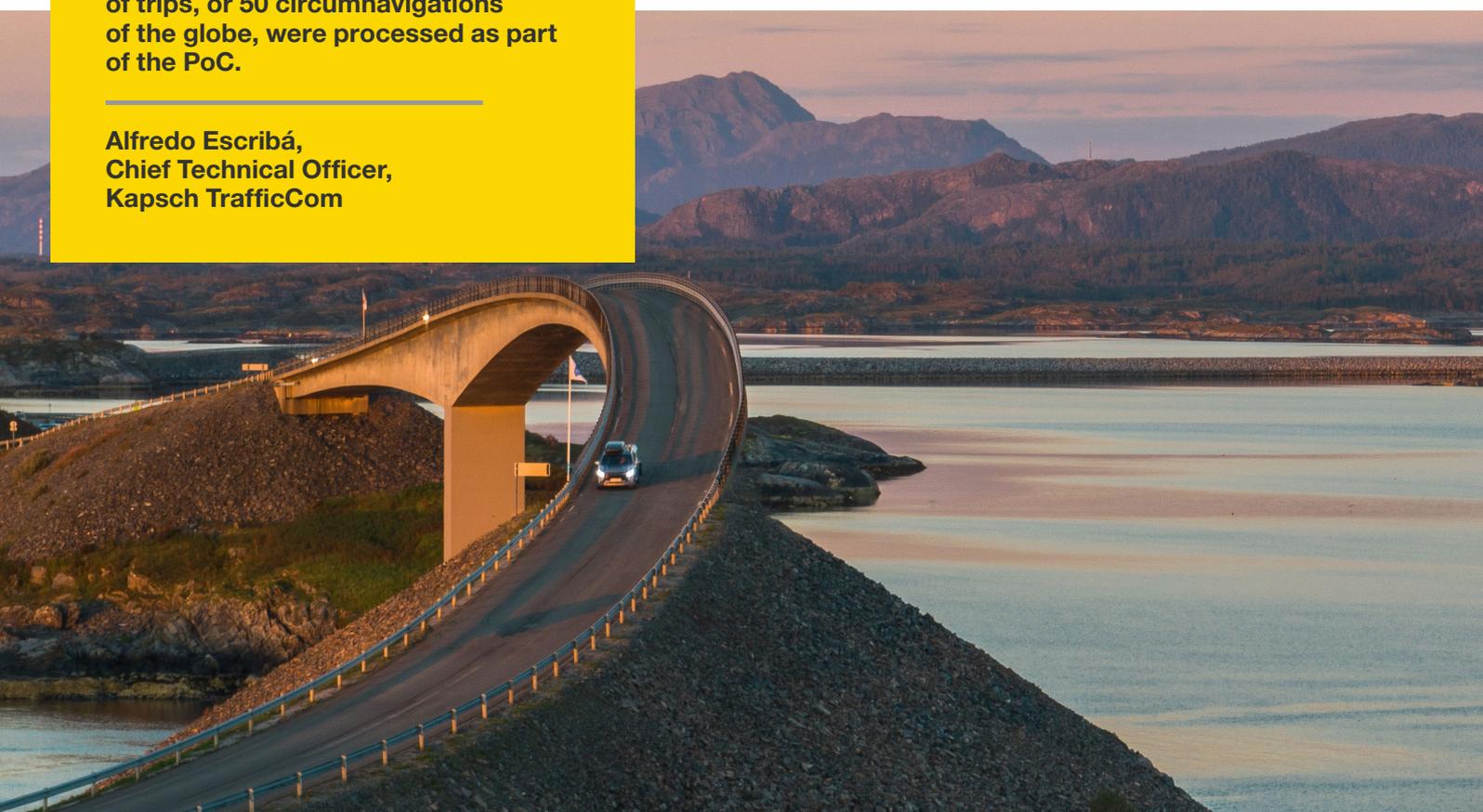
PoC Principles

The approach to the PoC was defined by six clear principles:

- 1 The solution should be as low cost and efficient to build, deploy and operate as possible
- 2 The solution should be flexible to meet the changing needs of the charging authority
- 3 The solution must deliver the highest possible KPIs
- 4 The solution should complement and not conflict with existing and neighboring solutions
- 5 The solution should be acceptable, affordable and easy to access for the end user
- 6 The solution must ensure complete transparency, integrity and security of user data

In total, more than 2 million kilometers of trips, or 50 circumnavigations of the globe, were processed as part of the PoC.

**Alfredo Escribá,
Chief Technical Officer,
Kapsch TrafficCom**





The JuztDrive Proof of Concept *System operation and data protection*

How does the system work?

The end-to-end process consisted of six steps:

1 The JuztDrive app is paired (via Bluetooth) with the desired vehicle and starts automatically when starting the engine

2 App records vehicle position each second and transmitted to Aveni C-ITS server

3 Positions are packaged and sent to the Kapsch GLP

4 Position packages are mapped to individual road segments and rated according to the tariff table provided by the charging authority (in this case the tariff table was produced by partners TØI)

5 Rated reports are sent back to the app as completed trips

Completed trips are displayed in the app with the price attached

6 A video of the system in action can be [seen here](#) ¹.

Data protection

The PoC complies with all relevant GDPR and EDPB guidelines and regulations, clearly informing the user that geo-location is taking place while only collecting data necessary for processing the trip.

Through a variety of measures, for example not storing the exact start and end positions of a trip and automatically deleting the data once the fee has been collected, user data is being handled carefully and transparently and in line with all applicable legislation.

Users provide their consent for collection and use of location data via the app – any users unwilling to consent should be provided with an alternative means of kilometer-based measurement and payment.

1: RUC POC Test 06OCT2022-A short - YouTube

The JutztDrive Proof of Concept

The Kapsch Geo Location Platform

Core element of the PoC

The Geo Location Platform (GLP) enables satellite tolling, road user charging and location-based business applications for public authorities and toll/fleet service providers. By providing toll context management, map matching and rating services via a scalable, device-agnostic platform, the GLP delivers the core processing capabilities to turn location data into a tangible asset.

The GLP is fully operated by Kapsch through the Azure cloud and provided as-a-Service, which ensures security, availability and scalability. Compared to an on-premise solution, this operating mode saves 85% of CO2 emissions, as no additional hardware is required at the client's site and power consumption is optimized.

The GLP streams data from any source into business value near real time

The Kapsch GLP is the central piece of the architecture when it comes to the Road User Charging and GNSS capabilities deployed in Norway. It is built around the concept of technology agnosticism when it comes to inputs, meaning that it can process data from a large range of devices, including on-board units and trackers, in-vehicle telematics and also mobile applications.

On the output side, the platform is also agnostic. It can support centralized charging schemes (an increasingly common market tendency) but it also enables tolling applications and decentralized schemes in a service provider space. The data generated by the system can also support a number of business applications as well as traffic and demand management focused use cases.

The general process of the GLP follows a simple scheme:

- 1 First, location data from C-ITS servers is received by the GLP through an API.
- 2 Once in the system, it is matched with map data from OpenStreetMap and tariff data from the tariff provider (usually a road authority) in order to build and rate trips.
- 3 Finally, the trip and charge report are sent back out to the C-ITS server.

The system was able to handle the challenging environments of the Norwegian road network, matching routes and calculating rates with an accuracy level above 99%.

**Mikael Hejel,
Area Sales Manager,
Kapsch TrafficCom**



Summary

Scalability and accuracy are central

99.5% rate accuracy

Over a period of three months, more than 2 million kilometers of trips were processed as part of the PoC, delivering valuable insights to Kapsch TrafficCom and Aventi Intelligent Communication.

When compared to precalculated prices for specific road segments, the system calculated rates at an accuracy level of 99.5%. Discrepancies only occurred when GNSS coverage was not accurate, particularly in tunnels. It is important to note that the system is not deterministic, but should be judged on its delivery of KPIs.

Geographical challenges were handled successfully

Overall, the Kapsch Geo Location Platform was able to successfully handle the challenging environments of the Norwegian road network with its dense urban environments, tunnels and residential areas as well as the ambiguous data inputs from at times sub-optimal GNSS coverage.

In total, over 80 million positions were processed during the PoC. The main portion coming from simulated test data and stress tests that were designed to evaluate the horizontal scalability of the system, which were passed without issue.

Scalability is central for sustainable nationwide use

This is particularly important as a nationwide system needs to be able to process hundreds of thousands of vehicles simultaneously. The infrastructure-light setup is essential in enabling rapid and flexible scalability across nations without a substantial difference in CO2 emissions of the system, making it the sustainable choice when compared to established, infrastructure-reliant solutions.



With this PoC, we are bringing together tolling technology and C-ITS in a way that has not been done before in Europe. We are excited to be at the forefront of technology and innovation once again

**Justin Hamilton,
Director, Location-Based Charging,
Kapsch TrafficCom**

Looking ahead

Exciting things to come

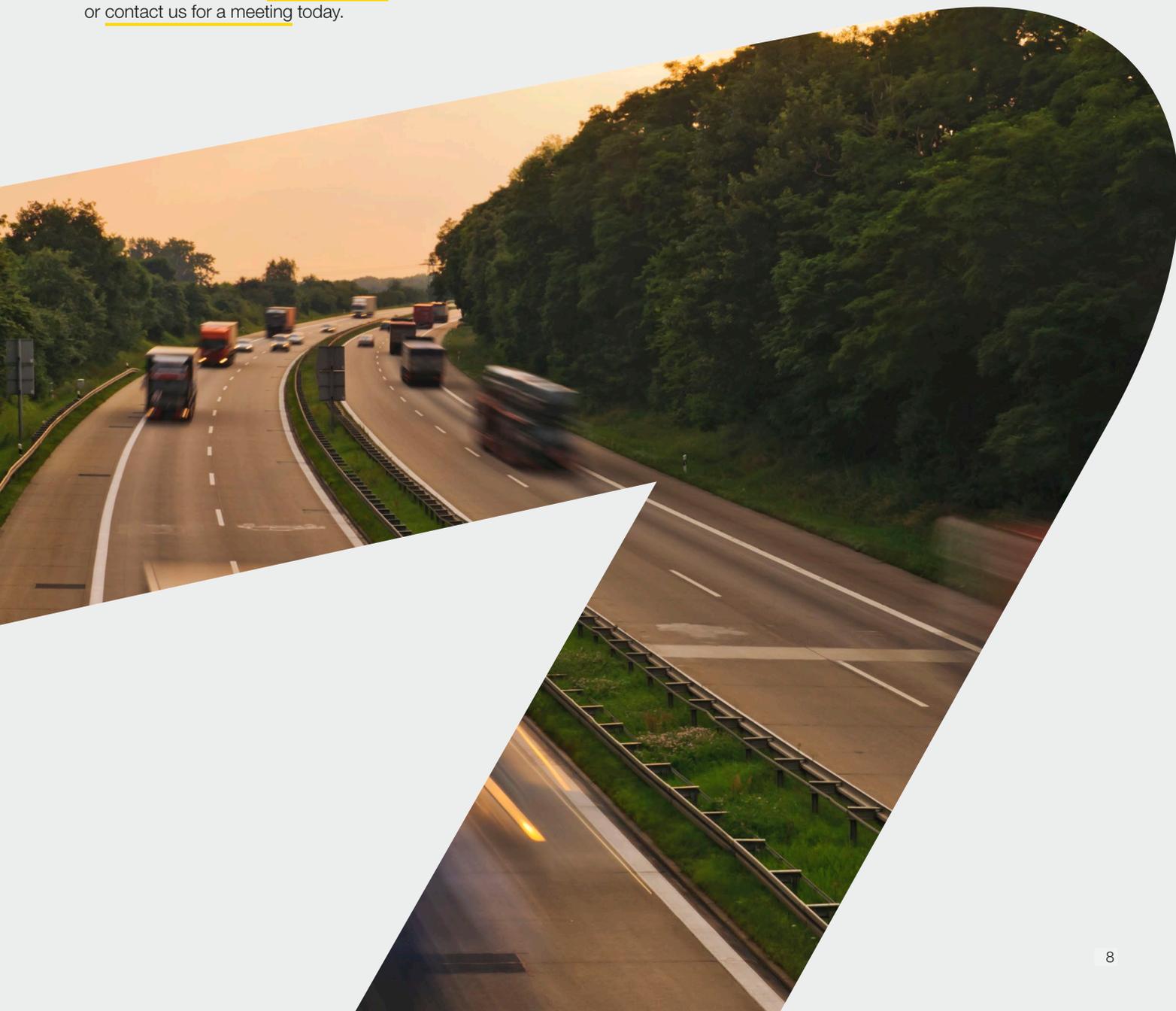
While the JuztDrive PoC and the cooperation with Aventi Intelligent Communication were a complete success, the technology is only at the beginning of its lifespan.

Further developments in adjacent technological areas, particularly in the field of Connected Vehicles, will heavily impact the future of the technology and how it will be used.

At Kapsch TrafficCom, we are always thinking about how we can support our partners to make the next step. From Connected Vehicles to distance-based charging to multi-modal mobility demand management – with our end-to-end solutions and products, we are enabling mobility across the full road transport spectrum.

If you want to learn even more about the JuztDrive PoC, visit kapsch.net or aventi.no.

For more information about Kapsch TrafficCom tolling solutions and services, and how they can help your organisation maximise efficiency through automation and deliver more convenient, value-added customer experiences, visit kapsch.net, or [contact us for a meeting today](#).



Kapsch TrafficCom

Kapsch TrafficCom is a globally renowned provider of transportation solutions for sustainable mobility with successful projects in more than 50 countries. Innovative solutions in the application fields of tolling, tolling services, traffic management and demand management contribute to a healthy world without congestion.

With one-stop-shop-solutions, the company covers the entire value chain of customers, from components to design and implementation to the operation of systems.

Kapsch TrafficCom, headquartered in Vienna, has subsidiaries and branches in more than 25 countries and is listed in the Prime Market segment of the Vienna Stock Exchange (ticker symbol: KTCG). In its 2021/22 financial year, 4,220 employees generated revenues of about EUR 520 million.

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