Deloitte.

RoadRevenue Maximiser

Deep learning enabled platform for toll operators

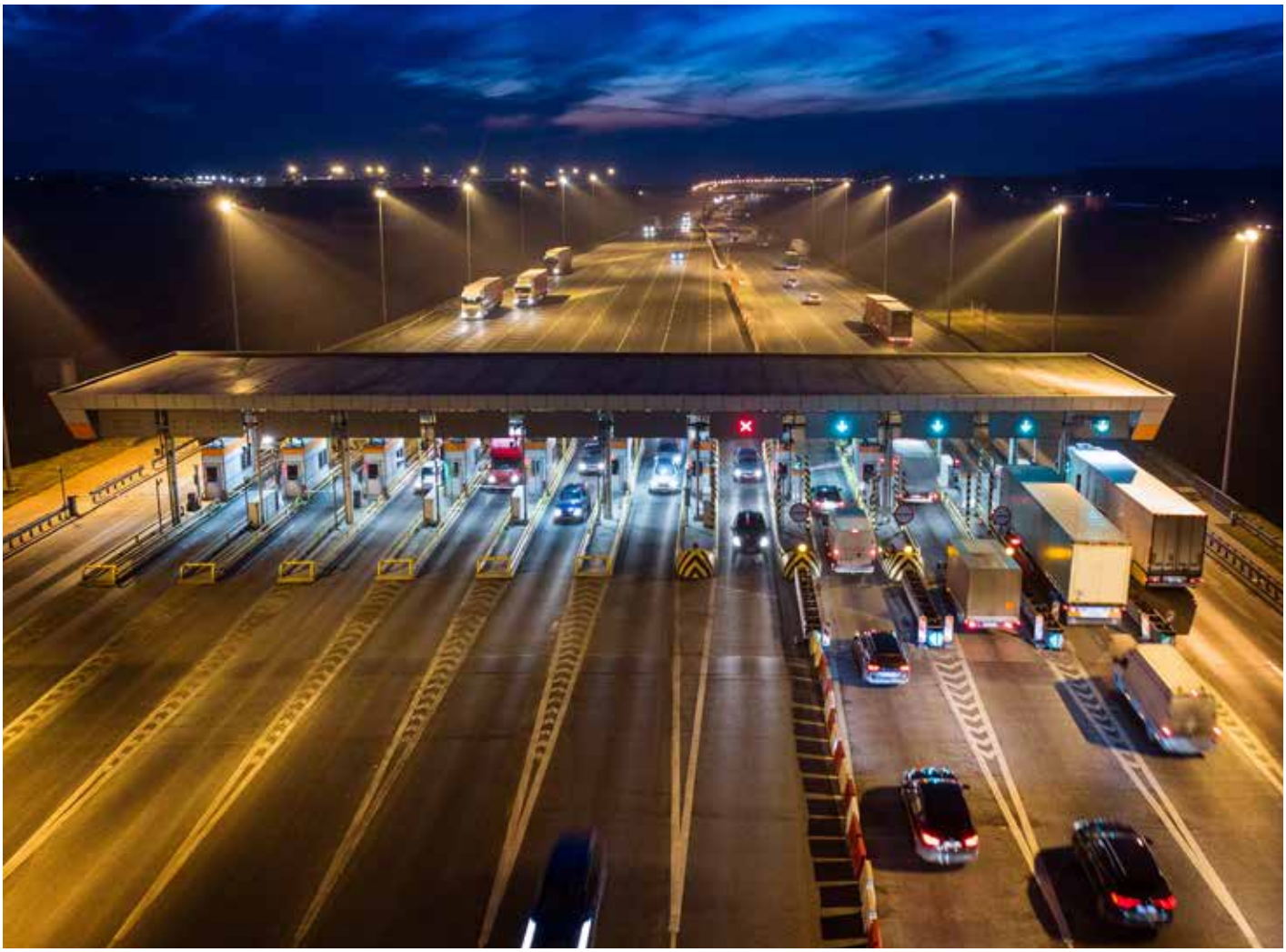
Private and confidential
October 2019

Risk Advisory

Introduction

Today, data analytics drive virtually every aspect of the business, from pricing to road asset management to fraud prevention. To capture the value that analytics can offer, management needs ready access to relevant data, along with the tools to uncover data insights that improve decisions and performance. Today, global organisations are using machine learning algorithms and other advanced analytics techniques to gain actionable insights from the massive data generated each day to evaluate real-time risks and avoid costly delays.

Deloitte's RoadRevenue Maximiser Solution Suite is an end-to-end platform that consolidates toll road data (image, video, transaction records) and provides intuitive insights to improve business agility and reduce revenue leakages by using deep learning capabilities. It provides real-time insights to businesses to tackle the operational challenges of managing unstructured data and complexity of essential data management.



Challenges in the current scenario

Toll roads businesses face a number of revenue leakage scenarios, which includes the following:

01 Same vehicle charged and exempted on different trips

02 Same vehicle exempted under multiple exemption categories

03 Vehicle misclassification by toll collector as well as the validator

04 Incorrect classification by AVC leading to transactions not being sent to validator

05 Same vehicle charged complete fare and extended local commercial discount on different trips

06 Inability to identify incorrect vehicle electronic toll collection tagging

07 Inability of system to detect violations, which leads to inaction from the concessionaires

Key differentiators

The RoadRevenue Maximiser difference

RoadRevenue Maximiser does double duty as a companion architecture to core toll road applications such as TMS and AVC. The analytics platform can draw data from TMS, ETC, etc., and integrate it with unstructured data such as images to identify the potential cases of revenue leakages. It also helps the validator and auditors in getting the real-time information required with predictive results to identify the cases of higher chances of irregularities. At the same time, management can use analytics to reduce the processing time and detect irregular events such as fraud. It can analyse the performance of their toll collectors and direct better the training and behavioural changes.

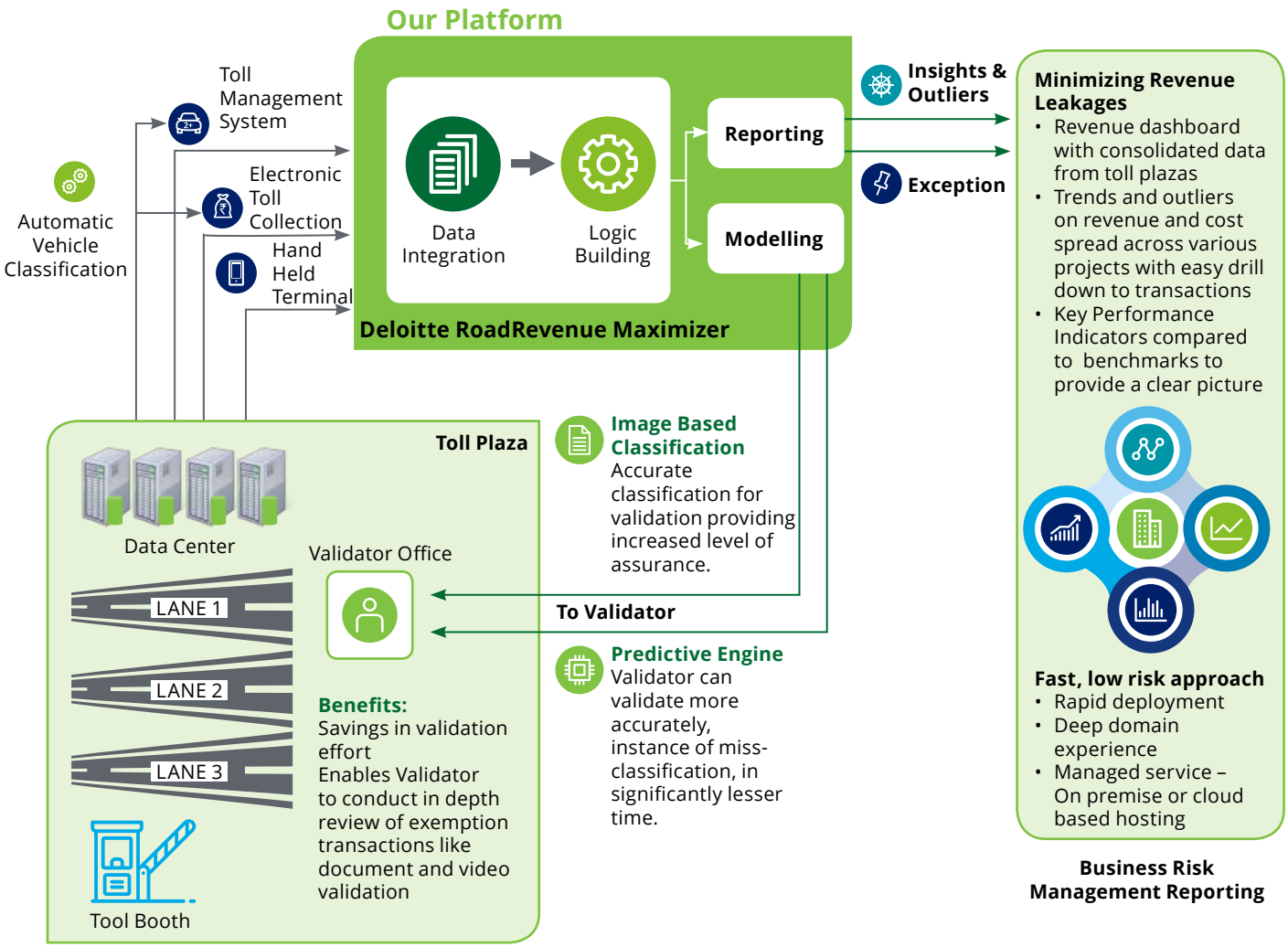
RoadRevenue Maximiser is a more intuitive and predictive approach unlike the traditional risk analytics approach. In this traditional approach the focus was more on historical data analysis with an intent to know "what happened" with regard to incorrect vehicle classifications and exemptions affecting concessionaire's revenue collection but does not answer "why it happened". Using machine-learning techniques improves the risk management capabilities due to its ability of semantic understanding of unstructured data to predict future outcomes.

Platform architecture

RoadRevenue Maximiser platform elements

A comprehensive kit of pre-built tools and data management services provides the foundation for advanced analytics.

Our platform integrated with the ecosystem of toll roads data



Platform offerings

1. Toll Operations: Insights and impact evaluator tool

Conduct analysis on high volumes of transaction data and highlight the transactions in which the concessionaire has incurred any revenue loss, the outliers, and indicate the causes for it. Analysis granularity is listed below:

Collector level analysis
Identifying collectors is causing most of the issues. For example, collectors provide wrong exemptions or wrongly classify most vehicles.

Vehicle level analysis
Analysing transactions of suspicious vehicles, which are being charged but sometimes are exempted and also, flagging transactions of vehicles that are frequently being exempted but under multiple exemptions categories.

Validator level analysis
Analysing validator performance in approving the false transactions.

Indicates collection by each collector, highlighting collector with highest collection

Shows number transactions and amount collected weekly basis over a period of scope

Indicates utilization and collection through multiple systems available viz. TMS, HHT and ETC

Shows the lane wise amount collected as per the vehicle class

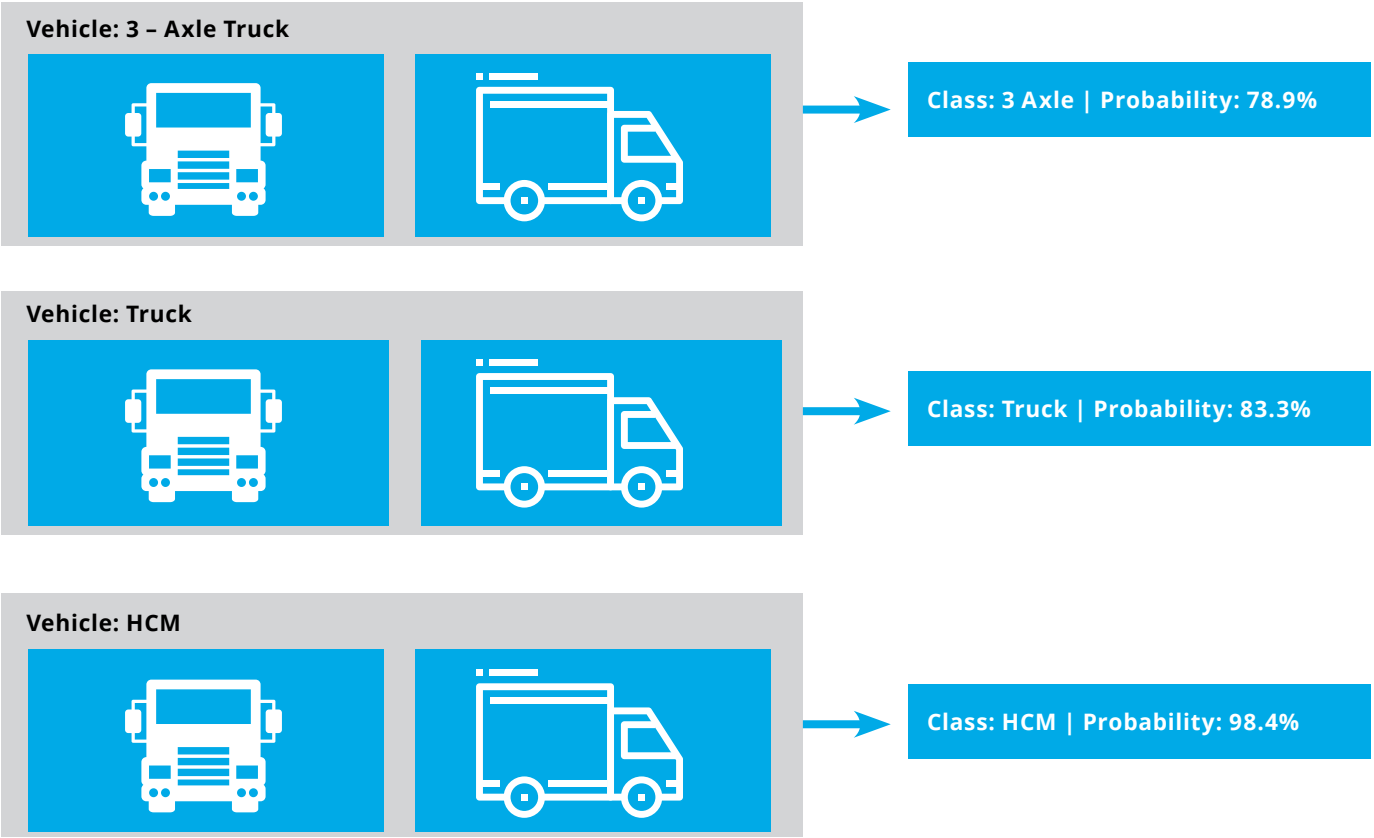
Shows the amount collected through various vehicle class for the entire period.

Shows the amount collected through various modes of payments

Sample Dashboard

2. Image-based vehicle classification

Our tool is designed to automatically identify different types of vehicles from image with neural networks. The tool helps in verifying the accuracy of vehicle classification done by the TC, thereby, serving as an automated validation tool for the concessionaires and preventing revenue loss.



3. High risk vehicle misclassification predictor

The risk of false validation for a vehicle misclassification leads to a silent and unnoticed revenue loss. The validator has to look through each transaction, since the ratio of vehicles misclassified is extremely small. Hence, the validation process requires consistent attention as well as more time. In this manual process of correctly recalling each misclassified transaction even a slight inconsistency can lead to false validation of misclassified vehicle.

Deloitte's machine-learning model is designed to aid the validation process by automatically flagging the potential high-risk events of vehicle misclassification. The predictive validation solution considers instances of both correct and wrong classification events with details such as vehicle type, time of day, shift of TC, etc. The model takes input as batch of recorded transactions, post processing the model flags the transaction that are high-risk events, which may have a potential vehicle misclassification.

Validator Focus

HIGH | Transactions with high-risk of potential vehicle misclassification

Vehicle Misclassification Risk Prediction Report

Ticket No.	Vechicle No.	TC Class	Trip	Category	Date Time	Shift	Lane	Payment	Mop	Way	Weight	TC ID	AVC Class	Risk
F423312	GJ12BV0872	3-AXLE	SINGLE	ETC	1/4/19 12:00 AM	2	6	195	ETC	To Exit	41564	RAHULM	3-AXLE	HIGH
D969774	GJ034360	CAR	SINGLE	PAID VEHICLE	1/4/19 12:00 AM	2	4	75	CASH	To Entry	15310	GAJANA	CAR	LOW
D969775	GJ12AF8095	HCM	LOCAL	PAID VEHICLE	1/4/19 12:01 AM	2	4	195	CASH	To Entry	21504	GAJANA	HCM	HIGH
H858186	GJ12WT5013	LCV	SINGLE	PAID VEHICLE	1/4/19 12:04 AM	2	10	120	CASH	To Exit	8765	PRAVIN	LCV	MEDIUM
D969777	GJ12LUZ5102	TRUCK	SINGLE	ETC	1/4/19 12:02 AM	2	4	270	ETC	To Entry	18540	MOHANL	TRUCK	HIGH
G977394	GJ03ND1472	CAR	SINGLE	PAID VEHICLE	1/4/19 12:02 AM	2	7	110	CASH	To Exit	13540	NANDIKI	CAR	LOW
B773559	GJ12AT8266	CAR	RETURN	PAID VEHICLE	1/4/19 12:03 AM	2	2	110	CASH	To Entry	12453	DATTAT	CAR	LOW
D969780	GJ12BT4785	BUS	SINGLE	ETC	1/4/19 12:03 AM	2	4	195	ETC	To Entry	12265	MOHANL	BUS	MEDIUM
H858187	GJ12Z3268	3-AXLE	SINGLE	ETC	1/4/19 12:03 AM	2	8	195	ETC	To Exit	31760	DATTAT	3-AXLE	HIGH
E418594	GJ18AZ8474	BUS	SINGLE	ETC	1/4/19 12:03 AM	2	5	250	ETC	To Entry	14654	RAHULM	BUS	MEDIUM
A665519	GJ12BT7212	HCM	LOCAL	PAID VEHICLE	1/4/19 12:04 AM	2	1	195	CASH	To Entry	21590	RAM	HCM	HIGH
A665521	GJ02Z6798	3-AXLE	LOCAL	PAID VEHICLE	1/4/19 12:06 AM	2	1	135	CASH	To Entry	37654	RAM	3-AXLE	HIGH
D969784	GJ12UI8335	LCV	LOCAL	PAID VEHICLE	1/4/19 12:06 AM	2	4	60	CASH	To Entry	12080	GAJANA	LCV	MEDIUM
J805326	GJ01CX6423	CAR	RETURN	PAID VEHICLE	1/4/19 12:06 AM	2	10	110	CASH	To Exit	14445	PRAVIN	CAR	LOW
I872103	GJ03T3754	TRUCK	SINGLE	PAID VEHICLE	1/4/19 12:06 AM	2	9	250	CASH	To Exit	15676	ARJUN	TRUCK	HIGH
E418596	GJ12BT5292	CAR	SINGLE	ETC	1/4/19 12:07 AM	2	5	110	ETC	To Entry	15467	MOHANL	CAR	LOW
D969785	GJ12BT5764	CAR	SINGLE	ETC	1/4/19 12:07 AM	2	4	110	ETC	To Entry	13224	RAHULM	CAR	LOW
B773563	GJ12AY5796	HCM	LOCAL	PAID VEHICLE	1/4/19 12:07 AM	2	2	195	CASH	To Entry	23241	DATTAT	HCM	HIGH

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