



BITBREW

Insurance Deep Dive

November 18, 2021

Agenda

- **Intro to BitBrew**
- **Platform Overview**
 - Platform Features
 - Cloud Architecture
 - Edge-to-AI Analytics
- **Insurance Use Case**
 - Device Integration (Optional)

Automotive Heritage

Our team lives and breathes automotive!



Founded in **1984** | **37** years of automotive engineering, ECU development & secure mobility solutions

800+ global engineers | **7** engineering centers globally | **5M+** devices deployed globally

Automotive OEM customers **12** | Tier-1 auto customers **32** | Production ECU programs **15** | Active Patents **5**



Founded in **2016** | **5** years of connected vehicle, insurance, fleet and smart city initiatives

35+ global engineers | **3** engineering centers | **2** cloud partnerships

global customers **15** | industry verticals **5** | edge devices **10** | messages Per month **10B+**

Customer Benefits

- ✓ Fast track time to market expectations
- ✓ Integrated approach for end-to-end solutions
- ✓ Secure, reliable and scalable
- ✓ Improves product / service quality and security
- ✓ Unlock new revenue opportunities
- ✓ Reduce operational costs
- ✓ Improve operations / service levels
- ✓ Deliver exceptional customer experiences

Partial Customer List



PART OF
TRAKGLOBALGROUP



Edge-to-AI Connected Vehicle Ecosystem



Ecosystem

- Telematics / OEM Data
- Connected Platform
- AI/ML driven Outcomes

Markets Served

- Fleets
- Insurance
- EVs
- Smart-City
- Transportation
- Auto OEMs



Services

Fleets

- Vehicle Health
- Fuel Economy
- Driver Behavior
- Impact Events

Insurance

- Driver Behavior
- Risk Score
- Vehicle Health
- Impact Events

EVs / Auto OEMs

- Performance Metrics
- Vehicle Health
- OTA Services
- Maintenance

Smart City

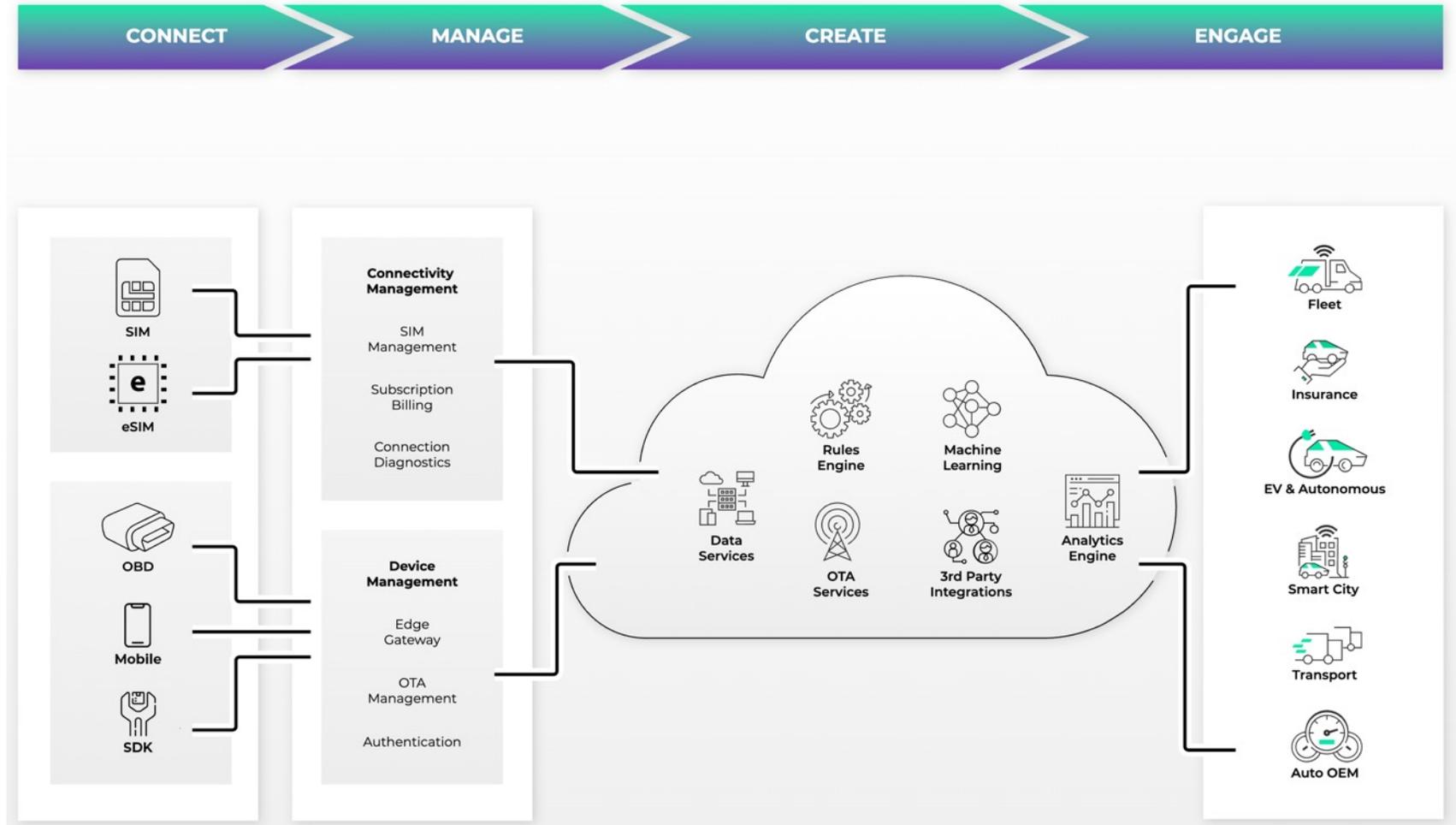
- V2X Connectivity
- Vehicle Pre-emption
- Traffic Priority
- Safety Alerts

Connected Vehicle Platform

- ✓ Edge Management
- ✓ Data Services
- ✓ OTA Services
- ✓ Cognitive Analytics



Aligned with **NIST 800-53**
and **ISO 26262** Standards



Device Management

- ✓ Device Integration
- ✓ Device Onboarding
- ✓ Device Provisioning
- ✓ Device Auth
- ✓ Device Diagnostics
- ✓ Security
- ✓ Reports & Analytics
- ✓ API's

The screenshot shows a web interface for device management. At the top, there is a search bar with a dropdown menu set to 'Serial Number' and a 'Search Devices' button. To the right of the search bar are several icons: a magnifying glass, a heart, a heart with a checkmark, a list icon, a refresh icon, a filter icon, a download icon, and a plus icon. A 'New Device' button is located on the far right. Below the search bar is a table with columns: Name, Group Name, Serial Number, Product Serial Number, IMEI, Config Version, and Last Communication. The table contains several rows of device data. A 'Shortcuts' menu is open over the first row, showing options: Go to Live, View Report, Network Management, View Activity, Download Activity, and Delete. A 'Download Options' menu is also open, showing options: Download All, Download Selected, and Download Custom. Callouts point to various features: 'Robust and intuitive Device Search' points to the search bar; 'Favourites Filter' points to the heart icons; 'Configure columns display' points to the list icon; 'Filter by Device Status or Group' points to the filter icon; 'Bulk Upload and edit options' points to the plus icon; 'Advanced Search BETA' points to the search bar; 'Refresh' points to the refresh icon; 'Download Options' points to the download icon.

Name	Group Name	Serial Number	Product Serial Number	IMEI	Config Version	Last Communication	
8049304444	Default Group	8049304444	2104232005	860548049304444	PbH5CF1811	2021-04-29 12:12:47	
8049331769	Default Group	8049331769	2104232011	860548049331769	T216L51341	PbH5CF1811	
8049241372	Default Group	8049241372	2104232022	860548049241372	T216L51341	PbH5CF1811	2021-04-29 12:20:49
8049333450	p	8049333450	2104232008	860548049333450	T216L51341	PbH5CF1811	2021-04-29 12:15:43
8049333211	p	8049333211	2104232025	860548049333211	T216L51341	PbH5CF1811	2021-04-29 12:14:20
8049333484	p	8049333484	2104232019	860548049333484	T216L51341	PbH5CF1811	2021-04-29 12:03:43
8049241307	p	8049241307	2104232007	860548049241307	T216L51341	PbH5CF1811	2021-04-29 12:08:38
8049241406	Default Group	8049241406	2104232009	860548049241406	T216L51341	PbH5CF1811	2021-04-29 11:58:56

Connectivity Management

- ✓ Carrier Integration
- ✓ Carrier Management
- ✓ SIM Management
- ✓ Carrier Security
- ✓ Data Management
- ✓ Alerts & Notifications
- ✓ Reports and Analytics
- ✓ APIs



The screenshot displays a mobile management interface for device 8046663735. It is divided into several sections:

- Device Info:** Lists details such as Serial Number (8046663735), IMEI (860548046663735), Sim CCID (8991102005239195918F), Status (Communicating), Last Communication (2021-05-07 00:15:03), Firmware/Config (T214L51341 / OFH5AF1811), First Communication (2021-02-02 11:14:34), Address, Name (8046663735), and VIN (WB1H3VLD1MRLK5076).
- SIM Info:** Shows SIM Number (8991102005239195918F), Commercial status (Active), Data Usage (38 MB), Profile Information (Profile 1: Bharti Airtel - Suspended, Profile 2: Bharat Sanchar Nigam Limited - Active), and Other Information (Primary MSISDN: null).
- Campaign Information:** Lists campaigns like 42_BS6_EEA_S_24 (Stage 1: Success) and 42_BS6_EEA_S_24_v512 (Stage 1: Success) with their creation and update dates.
- Order Information:** Shows a list of orders with dates and statuses like Delivered, First Communication, Activation Request Date, and Completion Date.
- Activity:** A detailed log of system events such as 'Updated firmwareVersion from T214v51232 to T214L51341', 'Updated configVersion from OFH5Ab1811 to OFH5AF1811', and 'Success in campaign 42_BS6_EEA_S_24 (Stage-1)'.

Annotations on the screenshot include:

- Device Info:** Points to the Device Information section.
- SIM Info:** Points to the SIM Information section.
- Graphs and Aggregate data:** Points to the top right area of the dashboard.
- Software Update Status:** Points to the Campaign Information section.
- Advanced Audit trail keeps track of any change in the system. Both old and new values are recorded:** Points to the Activity log.

Data Services

- ✓ Data Ingestion
- ✓ Data Processing
- ✓ Data Enrichment
- ✓ Data Destinations
 - API's (JSON)
 - Streaming Services (JSON)
 - REST
 - RabbitMQ
 - Kafka
 - Cloud Storage



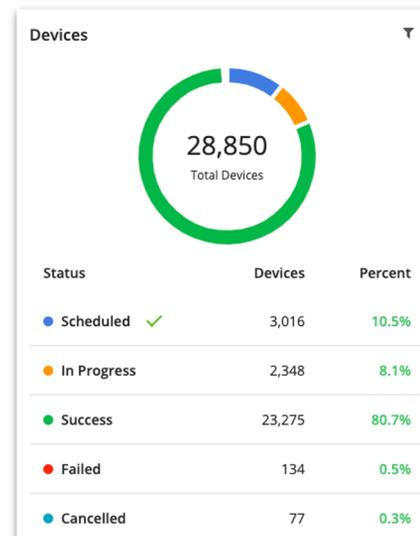
OTA Services

- ✓ OTA Campaigns
- ✓ COTA, SOTA, LOTA
- ✓ Update Orchestration
- ✓ End to End Security
- ✓ Data Management
- ✓ Vehicle Configuration
- ✓ Bandwidth Management
- ✓ Public and Private Cloud Support
- ✓ Reports and Analytics
- ✓ APIs

Dashboard **OTA Campaigns** Files

Serial Number Search

#	Campaign Name	Description	Label	Type	Status	Stages	Total Devices	Skip On Error	Retry
21	42_B56_EEA_S_12_AISEnable_17032021	EEA 12V-AIS	NoLabel	Device OTA	<div style="width: 100%; height: 10px; background-color: black;"></div>	Stage - 1	0	No	No
22	42_B56_EDC_S_12_AISEnable_17032021	EDC 12V-AIS	NoLabel	Device OTA	<div style="width: 100%; height: 10px; background-color: yellow; background-image: linear-gradient(to right, blue 40%, green 40%);"></div>	Stage - 1	4	No	No
23	L513_41_PbH5_CF	Plant mode-EDC	NoLabel	Device OTA	<div style="width: 100%; height: 10px; background-color: green; background-image: linear-gradient(to right, orange 10%, green 10%);"></div>	Stage - 1	42	No	No
24	OFH7_AF	EEA 24V-1sec	NoLabel	Device OTA	<div style="width: 100%; height: 10px; background-color: green;"></div>	Stage - 1	11	No	No
25	OeH7_AF	EEA 12V-1sec	NoLabel	Device OTA	<div style="width: 100%; height: 10px; background-color: black;"></div>	Stage - 1	0	No	No
26	ObH7_CF	EDC 24V-1sec	NoLabel	Device OTA	<div style="width: 100%; height: 10px; background-color: green;"></div>	Stage - 1	11	No	No
27	OaH7_CF	EDC 12V-1sec	NoLabel	Device OTA	<div style="width: 100%; height: 10px; background-color: green;"></div>	Stage - 1	2	No	No



New Campaign

Device OTA
Perform a device firmware or configuration change over the air.

ECU OTA
Perform an Electronic Control Unit base or calibration file change over the air.

TCP Command
Send a pre configured or custom command to the device and get a response.

SMS Command
Send a pre configured or custom command to the device via SMS.

Analytics Services

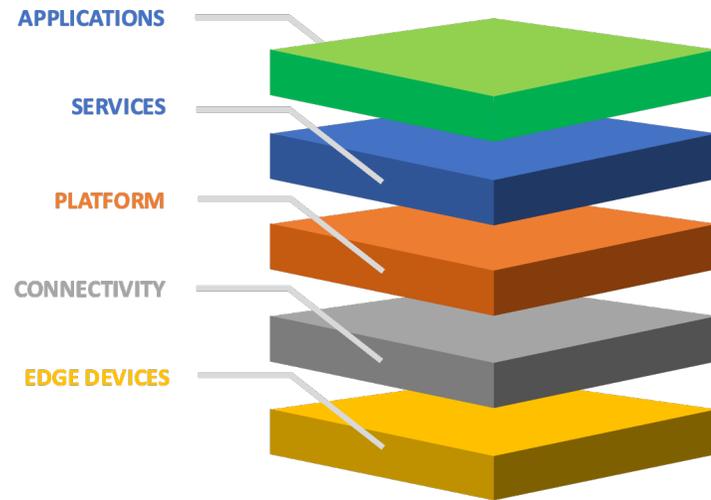
- ✓ Driver Behavior
- ✓ Driver Risk
- ✓ Impact Classification
- ✓ Pattern Mining
- ✓ Vehicle Health & Diagnostics
- ✓ Fuel Economy
- ✓ Battery Health
- ✓ EV Analytics

deepVIEW™

Analytics services for insights from vehicle data

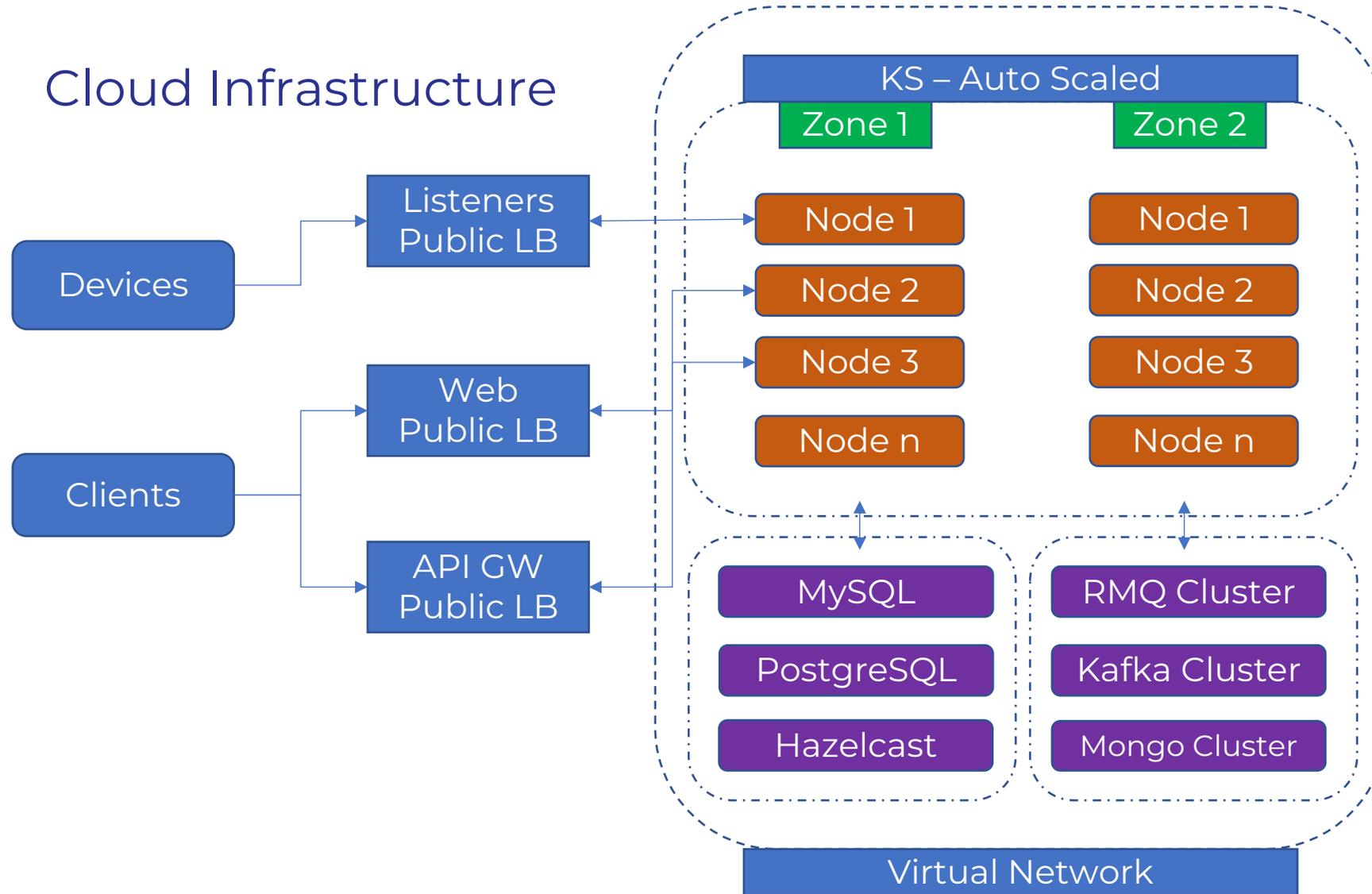


Architectural Overview



- Edge Cloud Architecture
- Multi Single Tenant Design
- Managed Platform
- Hybrid Cloud Support
- Global Availability

Architectural Overview



Proposed Azure Utilization

Services Used

- Kubernetes as a Service
 - All services are deployed in Kubernetes
- Load Balancers
- Gateways
- Monitoring
- Support
- VPN
- DNS
- Long Term Storage

Proposed Infrastructure

Type	# of Instances	vCPU	RAM	Disk (GB)
*.A1v2	20	1	2	
*.F2sv2	24	2	4	
*.D2av4	40	2	8	
*.D4av4	16	4	16	
*.D8dv4	24	8	32	
Totals	124	404	1,480	~4,000

Edge-to-AI



Vehicle Risk Score

- Behaviour Risk Scoring
- Insurance Risk Scoring



Fuel Economy Score

- Vehicle model specific score
- Monthly score - Actual Vs modelled fuel economy



Pattern Mining

- Trip patterns
- Diagnostic Associations



Impact Event Classification

- 100Hz accelerometer data of impact event
- Probability of crash
- Classification of crash



Anomaly Detection and Vehicle Health Scoring

- PID anomaly detection
- Vehicle health Score



Battery and EV Performance Score

- Battery Health Score based on charge cycle voltage-SOC relationship
- Battery Health Status for 12V lead-acid batteries



Modelling toolkit

- Exploration of univariate, bivariate and multivariate relationships between vehicle parameters
- Relationship with Fuel Economy (or other KPI)



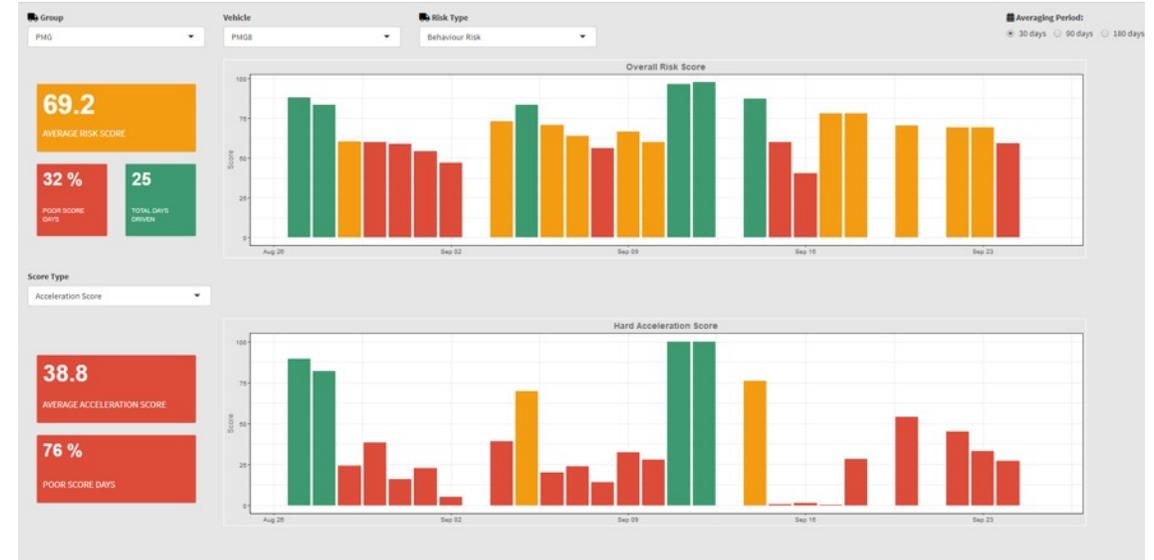
Road surface classification (TBD)

- 24Hz accelerometer data
- Features aggregated on device / server
- Classification of 'Poor', 'Fair' and 'Good' roads

Risk Scores

Behavior / Insurance Risk Score

- Weighted average of daily Hard Braking, Speeding and Hard Acceleration scores
- HB, HA and Speeding scores as risk factors derived from an Accident Risk model
- Idling Scores also considered as a separate behavioral score
- Exposure as additional risk factor (also derived from Accident Risk model)



Can help identify groups of vehicles with accident risk and specific behaviors leading to Accident Risk

Accident Risk Modeling

All Accidents: Cox semi-parametric hazard model

n= 5558, number of events= 644

	coef	exp(coef)	se(coef)	z	Pr(> z)
haper100mls	0.013	1.013	0.008	1.619	0.105
hbper100mls	0.079	1.082	0.022	3.607	0.0003 ***
osminper100mls	-0.007	0.993	0.008	-0.884	0.377
pslctper100mls	-0.002	0.998	0.007	-0.324	0.746
mlsperprday	0.011	1.011	0.001	7.893	0.000 ***
perc_stretch_lte2	0.061	1.063	0.005	11.117	< 2.00E-16 ***
perc_tripsct_lt8mls	0.007	1.007	0.003	2.283	0.0225 *
perc_pos_gt15mph	-0.055	0.947	0.005	-11.113	< 2.00E-16 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Concordance= 0.749 (se = 0.013)

Rsquare= 0.073 (max possible= 0.834)

Likelihood ratio test= 419 on 8 df, p=0

Wald test = 471.8 on 8 df, p=0

Score (logrank) test = 491.6 on 8 df, p=0

Preventable Accidents: Cox semi-parametric hazard model

n= 5199, number of events= 285

	coef	exp(coef)	se(coef)	z	Pr(> z)
haper100mls	0.016	1.017	0.011	1.447	0.148
hbper100mls	0.183	1.201	0.032	5.686	< 1.30E-8 ***
osminper100mls	-0.027	0.974	0.015	-1.778	0.075 .
pslctper100mls	-0.014	0.986	0.010	-1.416	0.157
mlsperprday	0.014	1.014	0.002	6.357	< 2.00E-10 ***
perc_stretch_lt2	0.060	1.062	0.008	7.243	< 4.40E-13 ***
perc_tripsct_lt8mls	0.007	1.007	0.005	1.466	0.143
perc_pos_gt15mph	-0.056	0.946	0.007	-7.532	< 5.02E-14 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Concordance= 0.756 (se = 0.019)

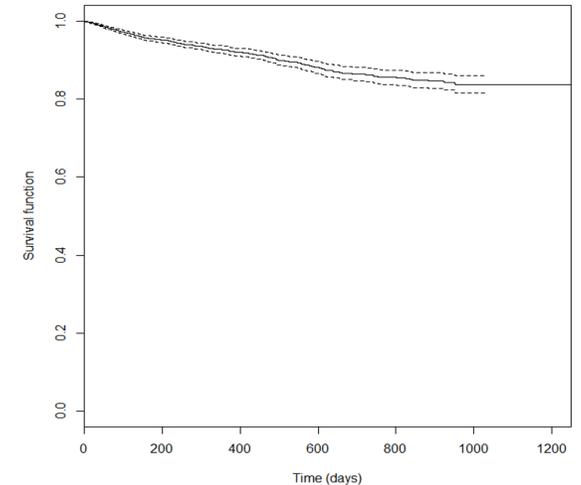
Rsquare= 0.039 (max possible= 0.57)

Likelihood ratio test= 206.1 on 8 df, p=0

Wald test = 223.8 on 8 df, p=0

Score (logrank) test = 226.5 on 8 df, p=0

Kaplan-Meier estimate with 95% confidence bounds - Preventable Acciden



- HB events per 100 miles is statistically significant in predicting Accident Risk (hazard)
 - 1 HB event/100 miles increases risk of a Preventable Accident by 20.1% (2 events increases risk by 44.1%)
- HA events per 100 miles not statistically significant at 0.1 p level but directionally related
 - 1 HA event/100 miles increases risk of a Preventable Accident by 1.7% (2 events increases risk by 3.3%)
- Speeding not directionally consistent - possibly because of high speeding across all drivers in consolidated model but significant for 1 fleet
 - 1 min of Speeding/100 miles increases risk by 1.07 times (7%) [10 minutes - 2 times]
- Exposure risk
 - Per mile of driving per day increases Accident risk by 1.1% (10 miles increases risk by 12.0% & 50 miles by 76.0%)
 - Per 1% increase in driving on unfamiliar stretches increases Accident Risk by 6.2% (10% increases risk by 84.1%)
 - Every 1% increase in driving trips less than 8 miles increases Accident Risk by 0.7% (10% increases risk by 7.6%)

Insurance – Connected Platform Use Case

BACKGROUND

Auto Insurance for Low Mileage drivers

- Device & Connectivity Management, Data Services, OTA Services
- Danlaw OBD Device with 3G/4G Connectivity
- 25 parameters
- Most parameters contribute towards Driver and Vehicle Score

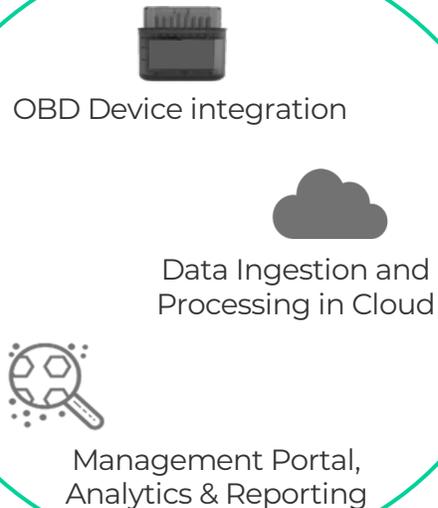
Insurance Provider

Passenger/
Commercial
Vehicles

Customer

Program Metrics

500K+ Device Program
Customers save up to
30%
Live for 2+ Years



Benefits

- Telematics Data Collection for Risk Reduction
- Program Outcomes
 - Usage Based Insurance
 - Encourage Safer Driving Habits
 - Vehicle health and Maintenance Partnerships
 - End User Application

Reduce Risk with Safe Driving

Reduce insurance and driver risk, encourage safe driving

DanLaw DL910 DataLogger - "PicoLogger"



Automotive Grade

- Safe, Reliable, Secure
- Made in the USA and built to the same standards as our OEM ECU's
- Load dump – protects vehicle against electrical surges
- Operating Temperature Range: -40 °C to +85 °C
- RoHS Compliant – Environmentally Safe
- Built to last 6 years vs 2-3 years for competitor's consumer grade devices.
- Durable. Extremely low failure rate 51 PPM
- Polycarbonate (Lexan) plastics. High Quality, durable & abrasion resistant

Highest Compatibility in North American Vehicles

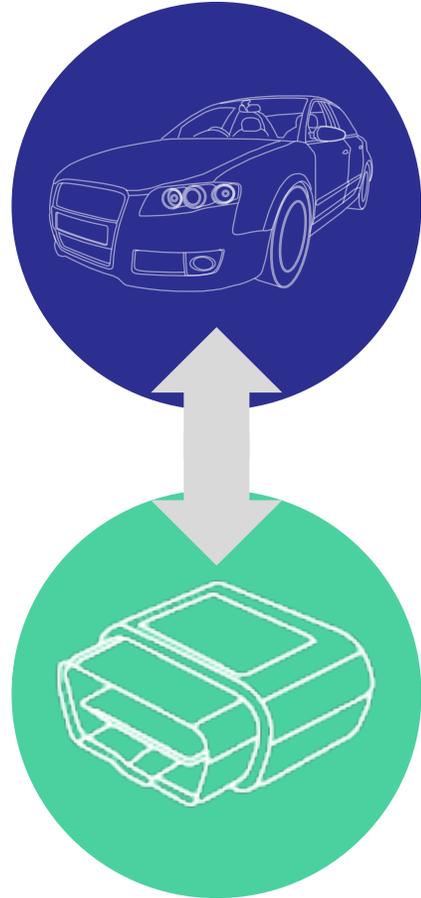
- 98% + of all cars are compatible (1996 to present)
- Detailed compatibility lists and VECO API (Vehicle Compatibility Database)

High Level Specs

- OBD2 data collection (MY 2005 to present)
- Ultra low profile (only 17mm)
- WiFi client connectivity
- BLE connectivity to smartphone
- Uses smartphone or WiFi to send data
- GNSS & Accelerometer

Compression and optimized custom firmware reduces data costs by up to 60%

Sample Vehicle Data/Events



Vehicle Parameters
VIN – Vehicle Identification Number
ODO – Vehicle Odometer
VSS – Vehicle Speed
RPM – Engine RPM
VBATT – Vehicle Battery Voltage
LOAD – Engine Load
Throttle Position
Coolant Temperature
Fuel Level
Fuel ECON/Fuel Use
PIDs - Parameter ID's Supported
MIL – Malfunction Indicator Lamp Status
DTCs – Diagnostic Trouble Codes
GPS Position (LAT, LON, ALT)
3-Axis Accelerometer (x, y, z)

Events
Trip Start / Trip End Events
Connect / Disconnect Events
Hard Breaking Events
Speeding Events
Hard Acceleration Events
Cornering Events
Impact Events
Time-of-Day Events
GEO Fence Events
MIL ON Event
Sensor-to-Car Normalization
Low Vehicle Battery Level Events



BITBREW

The collage displays various BITBREW interface components:

- Live Status Dashboard:** Shows 11 Communicating (61.1%), 0 Not Communicating (0%), 0 Disconnected (0%), and 7 Not Connected.
- Vehicle Detection:** A camera feed showing a car on a road with green bounding boxes and labels for 'vehicle'.
- Bar Chart:** A chart showing data points over time, with a legend for 'Name' and 'Jon Dev'.
- Line Graph:** A line graph showing a signal over time, with a legend for 'Name' and 'Jon Dev'.
- Calendar:** A calendar view showing dates from July 2021 to September 2021.



Risk Score Development

Risk Scoring

- Exposure Risk (time-of-day weighted miles)
 - Congestion, unfamiliar stretch driving, trip length
- Behavioral Risk (Hard Braking, Speeding, Hard Cornering, Hard Acceleration, Distracted Driving, Seat belt use)
- Multiple Scores
 - Daily Scores for Drivers/Vehicles for behavioral change
 - Cumulative Aggregated scores – Fleet Scores for different Time periods (6-monthly, since inception) for Inscos

Behavior Risk based on:

- Magnitude of events using defined speed bands, braking and acceleration intensities
- Duration of events (speeding)
- Spatio-temporal index of each event (conditions under which event took place)
 - Time of event - Low, medium and high-risk periods
 - Weather conditions during event: snow or rain = greater risk
- Frequency of events
- Weighted by Vehicle Class (indicated by GVW) to factor in additional risk posed by heavier vehicles

Risk Score highly correlated with Accident Risk

DanLaw Telematics/Edge Devices

DL970 - OBD



4G LTE CAT 1 – SuperCap
WiFi Client



DL980 - OBD



4G LTE CAT 4 - LiPo Battery
WiFi Hot Spot



DL540 - TCU



Telematics Control Unit
4G LTE CAT 4 – Li-Ion Battery



V2X - OBU



On-board Unit
DSRC & C-V2X - GNSS



V2X - RSU

Roadside Unit
DSRC & C-V2X – IPV6/V4



Insurance – Key Personas



Product Development

- ✓ Program Administration
- ✓ Product testing
- ✓ Risk / Liability Analysis
- ✓ Reports and Analytics

Business Stakeholders

- ✓ Program Management
- ✓ Value Added Services
- ✓ Reports and Analytics
- ✓ Data to Sales & Marketing

IT Stakeholders

- ✓ Managed Services
- ✓ End to End Security
- ✓ APIs
- ✓ System Integrations

Fulfillment Team

- ✓ Order management
- ✓ Program Fulfillment
- ✓ Logistics
- ✓ Reports and Analytics

Customer Operations

- ✓ Policyholder Support
- ✓ Program Enrolment
- ✓ Issue Resolution
- ✓ Reports & Analytics

Usage based Insurance - Reduce Risk, Improve Safety and enhance Customer Experience