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)

BITBREW
A DANLAW Company

Automotive Heritage

Our team lives and breathes automotive!

DANLAW
AUTOMOTIVE MADE SMART

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**

BITBREW
A DANLAW Company

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

BITBREW
A DANLAW Company

Partial Customer List

BITBREW
A DANLAW Company

Edge-to-AI Connected Vehicle Ecosystem

BITBREW

Ecosystem

- Telematics / OEM Data
- Connected Platform
- AL/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

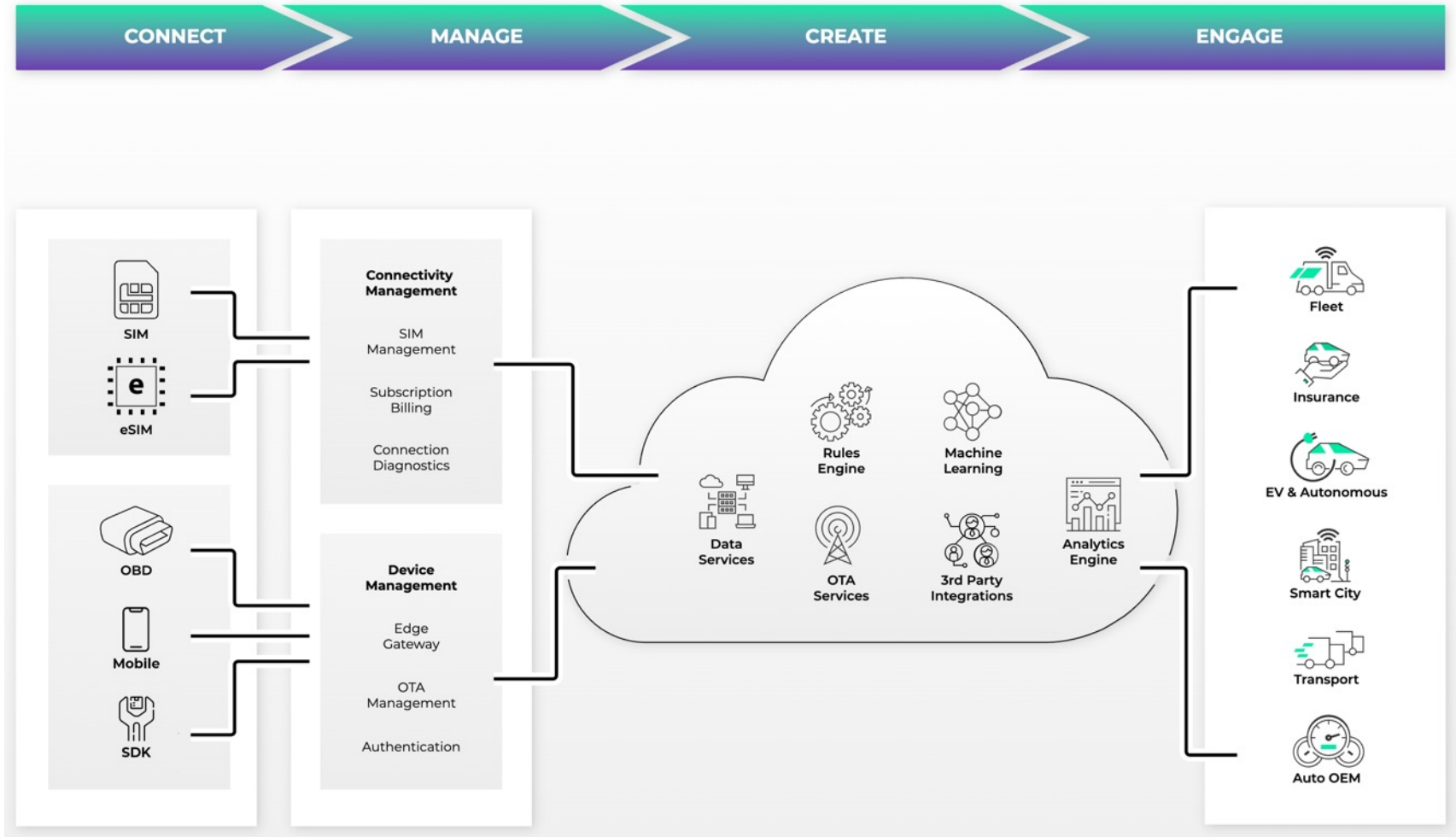
Smart City
- V2X Connectivity
- Vehicle Pre-emption
- Traffic Priority
- Safety Alerts

BITBREW
A DANLAW Company

Connected Vehicle Platform

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

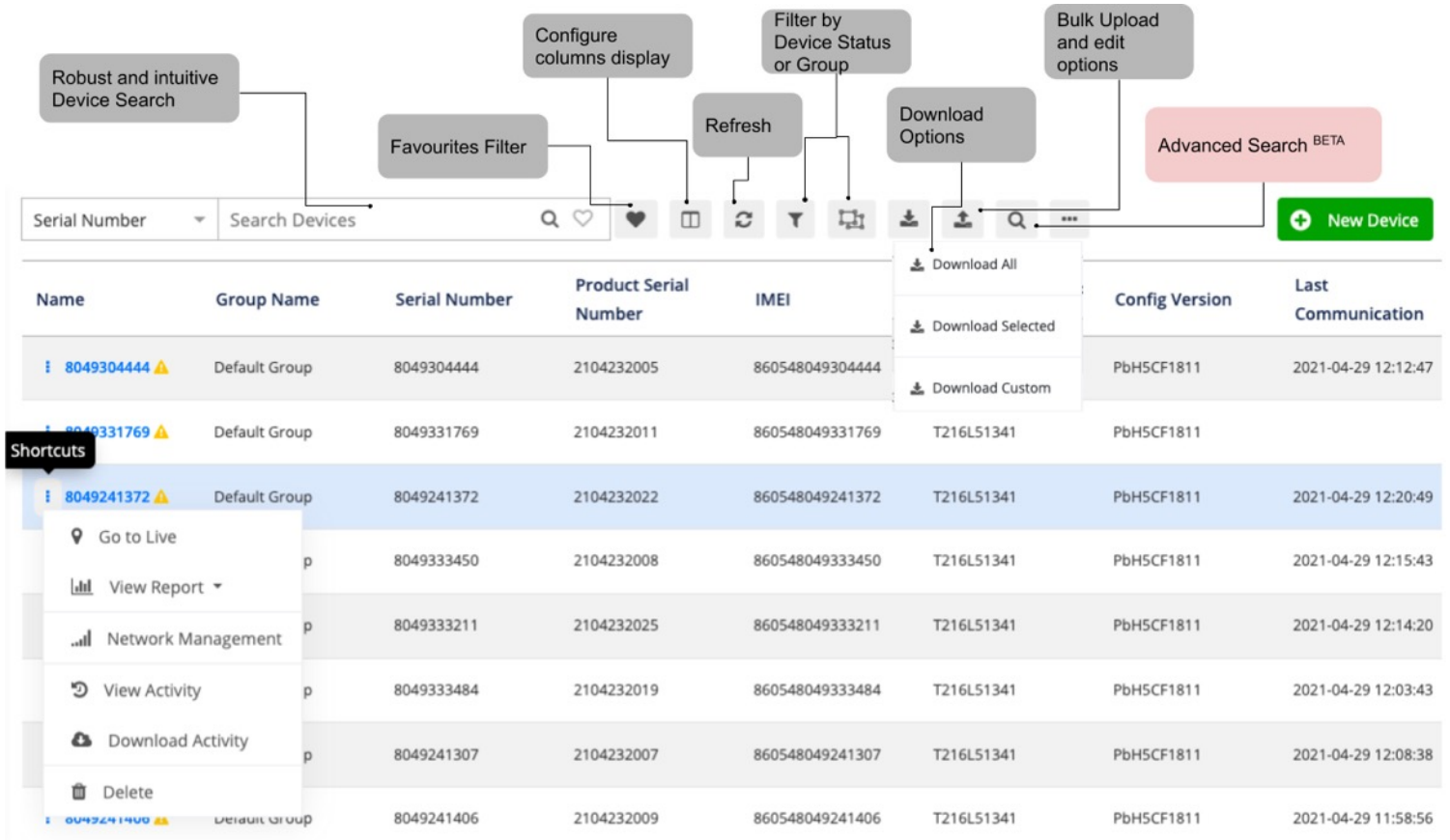
Aligned with **NIST 800-53** and **ISO 26262** Standards



BITBREW
A DANLAW Company

Device Management

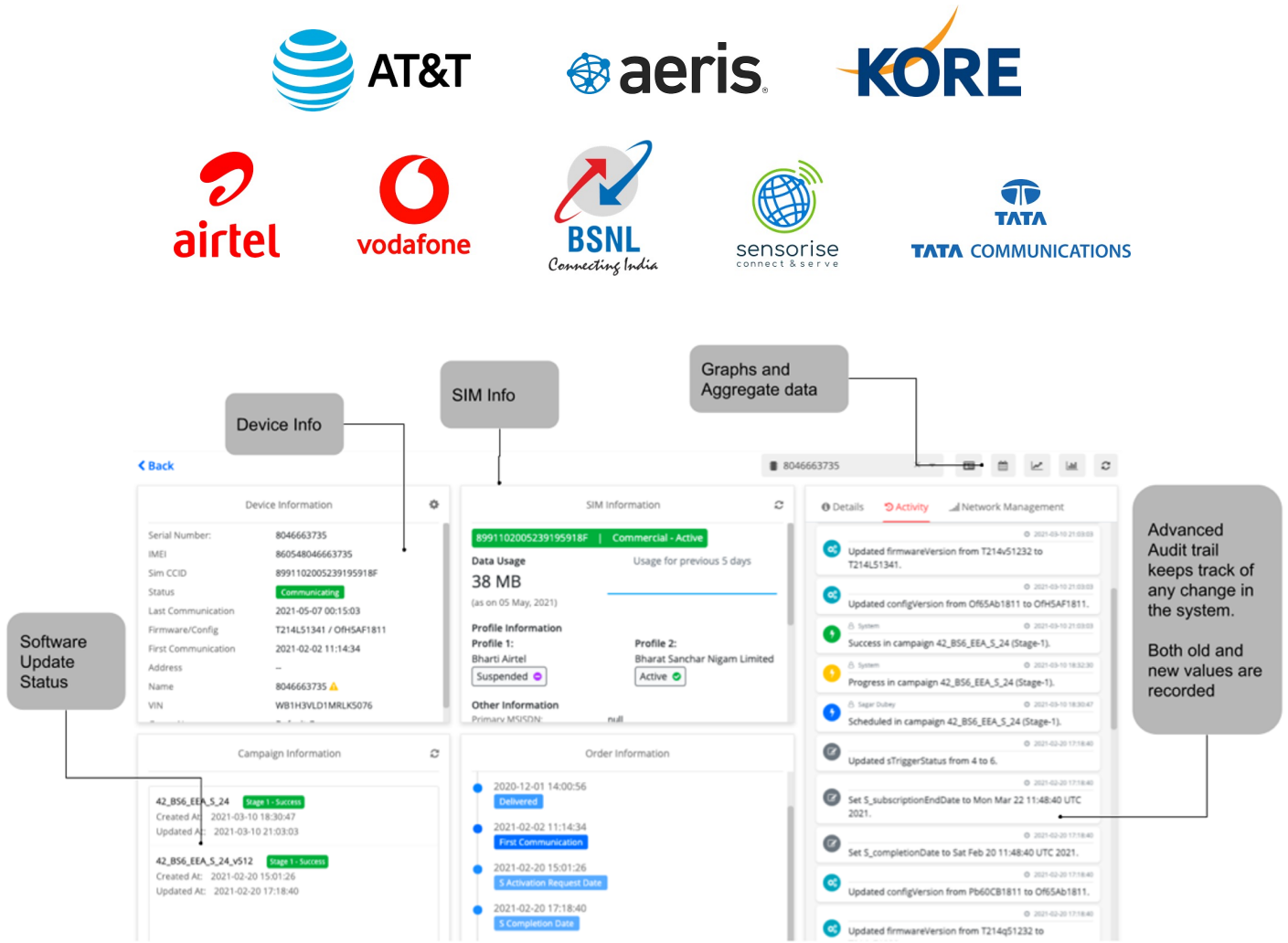
- ✓ Device Integration
- ✓ Device Onboarding
- ✓ Device Provisioning
- ✓ Device Auth
- ✓ Device Diagnostics
- ✓ Security
- ✓ Reports & Analytics
- ✓ API’s



BITBREW
A DANLAW Company

Connectivity Management

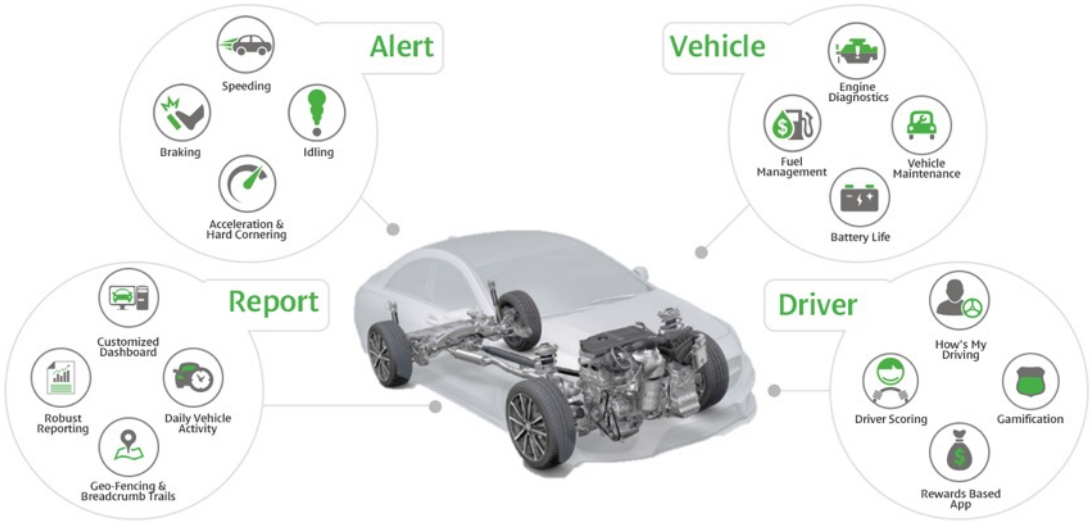
- ✓ Carrier Integration
- ✓ Carrier Management
- ✓ SIM Management
- ✓ Carrier Security
- ✓ Data Management
- ✓ Alerts & Notifications
- ✓ Reports and Analytics
- ✓ APIs

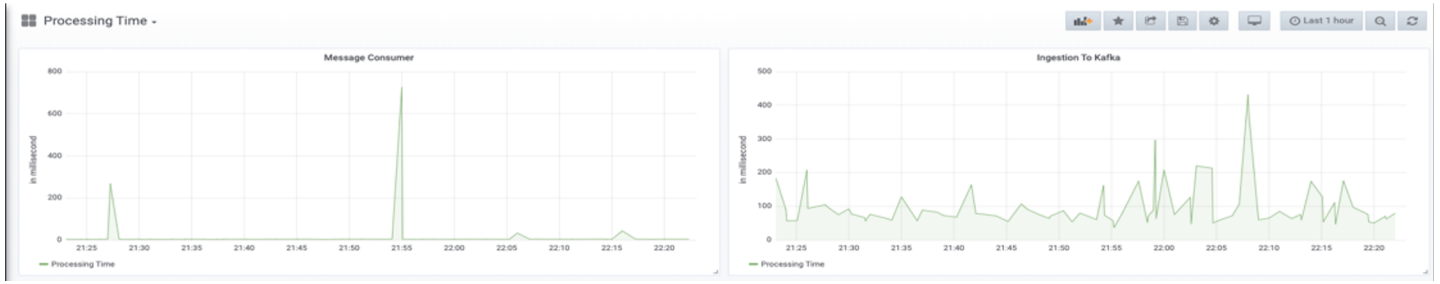


BITBREW
A DANLAW Company

Data Services

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

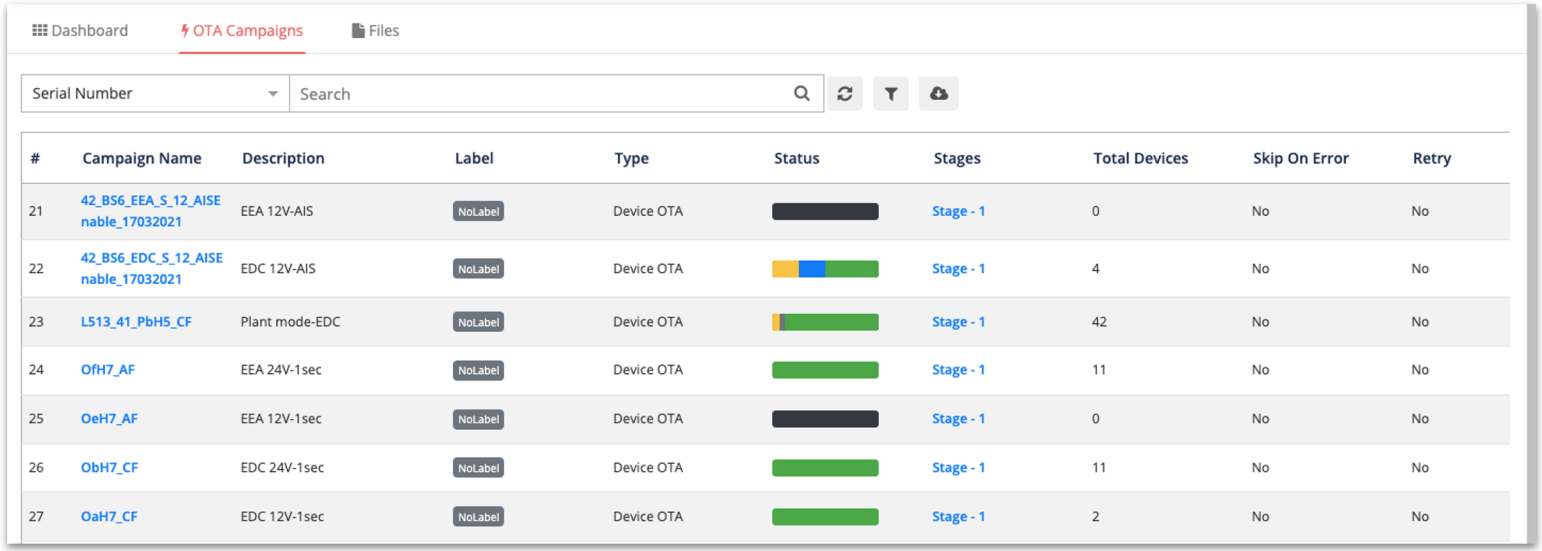




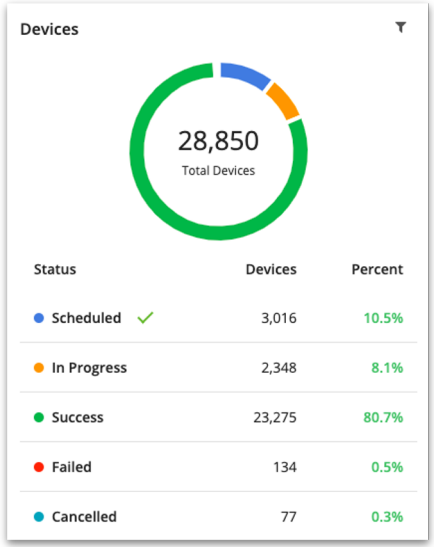
BITBREW
A DANLAW Company

OTA Services

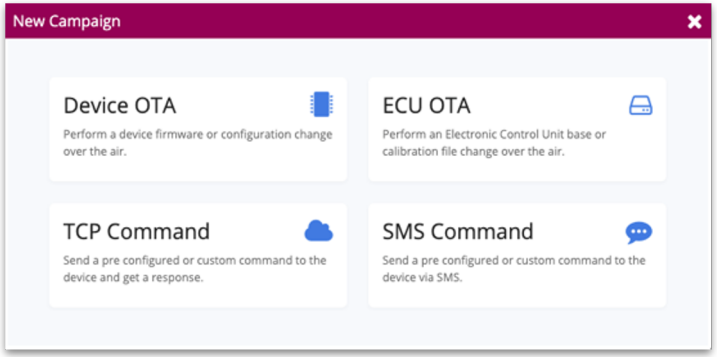
- ✓ OTA Campaigns
- ✓ COTA, SOTA, LOTA
- ✓ Update Orchestration
- ✓ End to End Security
- ✓ Data Management
- ✓ Vehicle Configuration
- ✓ Bandwidth Management
- ✓ Public and Private Cloud Support
- ✓ Reports and Analytics
- ✓ APIs



#	Campaign Name	Description	Label	Type	Status	Stages	Total Devices	Skip On Error	Retry
21	42_BS6_EEA_S_12_AISEnable_17032021	EEA 12V-AIS	NoLabel	Device OTA		Stage - 1	0	No	No
22	42_BS6_EDC_S_12_AISEnable_17032021	EDC 12V-AIS	NoLabel	Device OTA		Stage - 1	4	No	No
23	L513_41_PbH5_CF	Plant mode-EDC	NoLabel	Device OTA		Stage - 1	42	No	No
24	OfH7_AF	EEA 24V-1sec	NoLabel	Device OTA		Stage - 1	11	No	No
25	OeH7_AF	EEA 12V-1sec	NoLabel	Device OTA		Stage - 1	0	No	No
26	ObH7_CF	EDC 24V-1sec	NoLabel	Device OTA		Stage - 1	11	No	No
27	OaH7_CF	EDC 12V-1sec	NoLabel	Device OTA		Stage - 1	2	No	No



Status	Devices	Percent
Scheduled ✓	3,016	10.5%
In Progress	2,348	8.1%
Success	23,275	80.7%
Failed	134	0.5%
Cancelled	77	0.3%



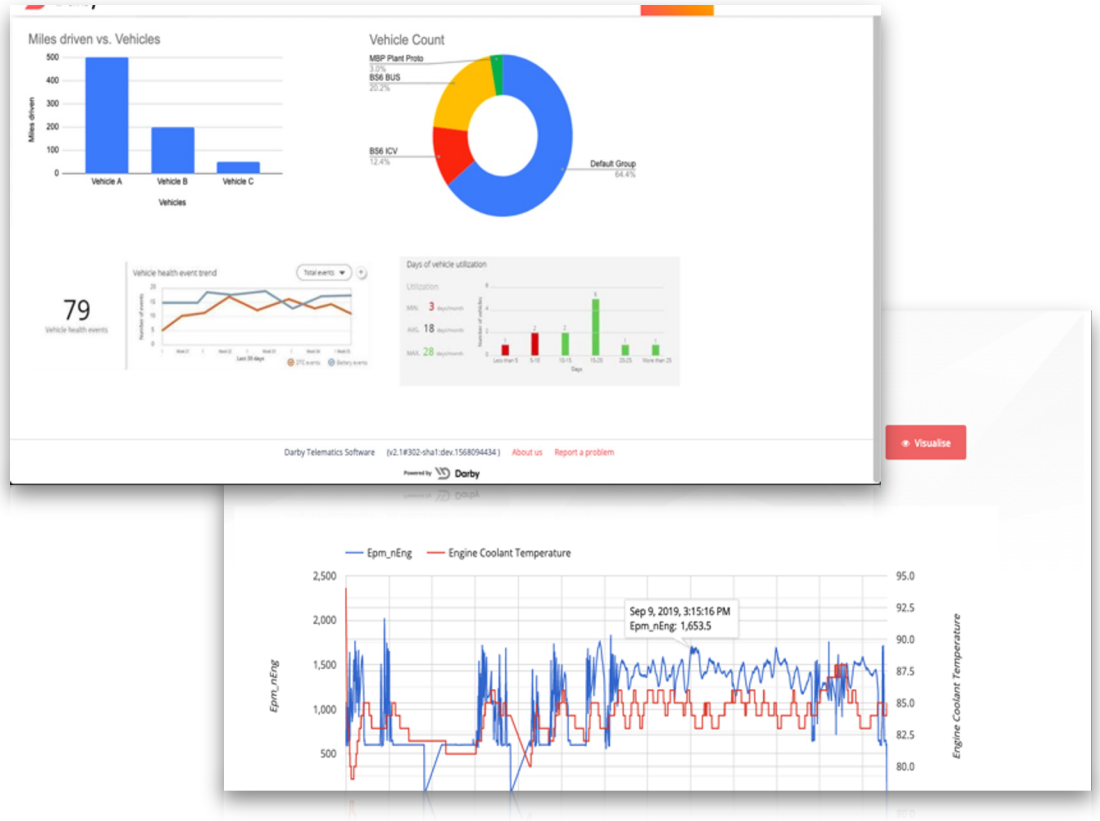
BITBREW
A DANLAW Company

Analytics Services

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

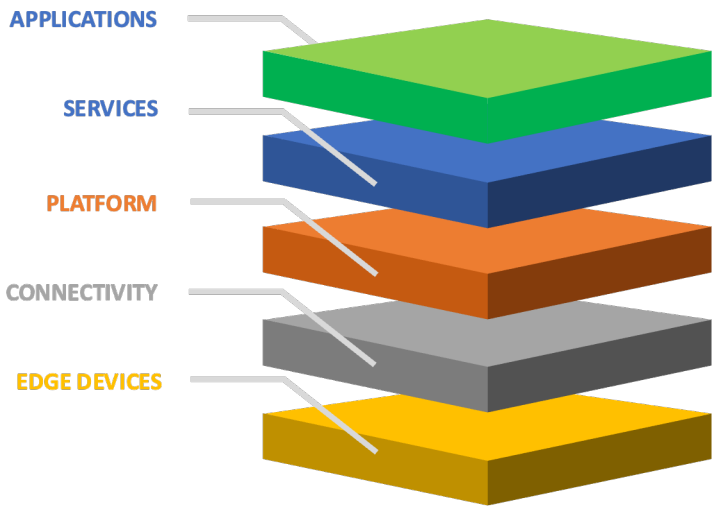
deepVIEW™

Analytics services for insights from vehicle data



BITBREW
A DANLAW Company

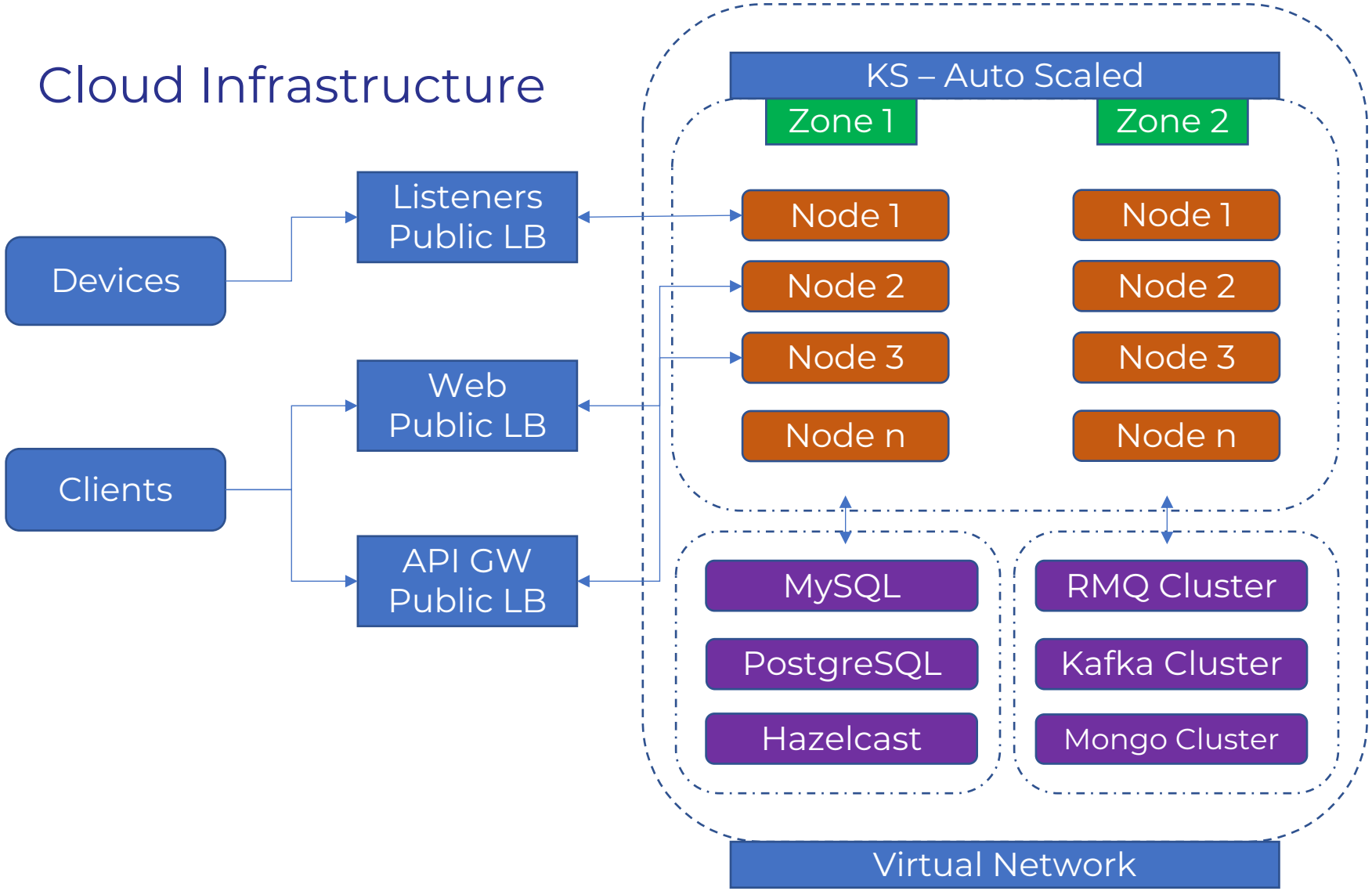
Architectural Overview



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

BITBREW
A DANLAW Company

Architectural Overview



BITBREW
A DANLAW Company

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**

BITBREW
A DANLAW Company

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

BITBREW
A DANLAW Company

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

BITBREW
A DANLAW Company

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

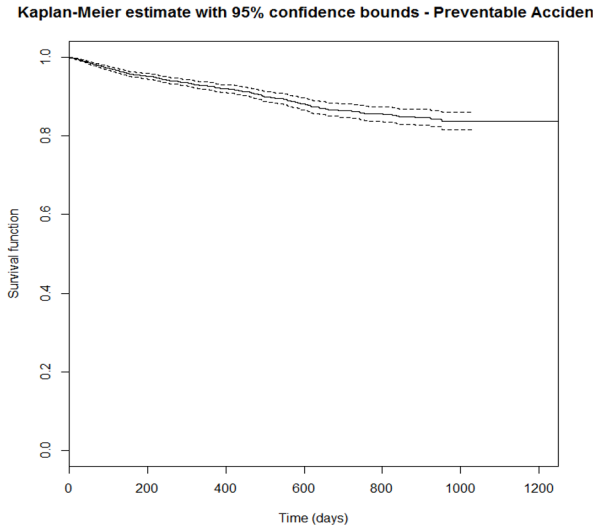
Preventable Accidents: Cox semi-parametric hazard model

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



- 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%)

BITBREW
A DANLAW Company

Insurance – Connected Platform Use Case

Insurance Provider

Passenger/ Commercial Vehicles

Customer

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

OBD Device integration

Data Ingestion and Processing in Cloud

Management Portal, Analytics & Reporting

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

BITBREW A DANLAW Company

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)

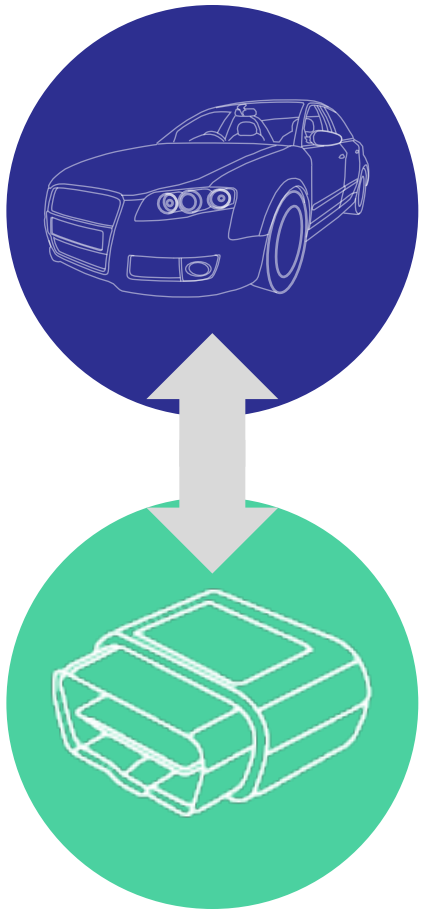
High Level Specs

- 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%

BITBREW
A DANLAW Company

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
A DANLAW Company

BITBREW


BITBREW
Analytics > Reports
Live
Dashboard
Edge
Data
OTA
Analytics
Admin
Jon
Live Status
Search
Data
User
System
11
Communicating
61.1 %
0
Not Communicating
0 %
0
Disconnected
0 %
7
Not Connected
vehicle
Name
Ben Dev
Last 7 Days
Speeding
Hard Acceleration
Map
Satellite
City
TRAVEL

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

BITBREW
A DANLAW Company

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

BITBREW
A DANLAW Company

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

BITBREW
A DANLAW Company