Google Cloud

PROFESSIONAL CLOUD ARCHITECT

KnightMotives Automotive Case Study

Company Overview

IOT device so Bigtable
Storing vast time-series data efficiently – e.g. Cloud Bigtable for high-speed writes and per-vehicle queries, combined with BigQuery for large-scale analytics on aggregated data

KnightMotives is a car manufacturer specializing in autonomous, self-driving vehicles, including Battery Electric Vehicles (BEVs), hybrids, and traditional internal combustion engine (ICE) vehicles. While KnightMotives has made strides with the in-vehicle experience in their BEV fleet, the hybrid and ICE vehicles have yet to implement these new systems and are viewed poorly by critics and drivers. The lack of modern in-vehicle technology in hybrid and ICE vehicles has resulted in declining sales and customer satisfaction.

KnightMotives wants to modernize the consumer experience across all vehicles within five years. Artificial Intelligence offers a unique opportunity to revolutionize the in-vehicle experience, as well as the shopping, buying, and service/maintenance experience. Investment in this new technology will require a shift in financial priorities on a global scale.

KnightMotives also wants to improve their online ordering system, which is unreliable. Systems for customers to build their vehicle online for acquisition through a dealer are not delivering the data or reliability that dealers need, causing a strain in the relationship between KnightMotives and dealers. Service technicians and sales staff need better tooling to enhance dealer successes, including built-to-order vehicles.

Solution Concept

KnightMotives wants to shift from manufacturing cars to creating a complete and compelling "automotive experience." Their strategy prioritizes delivering a consistent experience across all models, developing AI-powered features, generating new revenue from data monetization, adopting a digital focus to differentiate their brand from competitors, and developing better tools for mechanics and salespeople.

Existing Technical Environment

KnightMotives's IT is largely on-premises with some applications on major cloud platforms. Their supply chain runs on an outdated mainframe, and Enterprise Resource Planning (ERP) is also outdated, making new promotions and dealer discounts difficult to implement. Dealers have no budget for new equipment. There is fragmentation across vehicles with multiple code bases, and significant technical debt from supporting backwards compatibility. Network connectivity to manufacturing plants and vehicle connectivity in rural areas are challenges.

Business Requirements

Key business requirements include fostering a personalized relationship with the driver and delivering a cohesive experience across all models. Creating a better build-to-order model will reduce time on the lot and provide transparency for both dealers and customers. Additionally, KnightMotives seeks to monetize corporate data to finance new technology investments, as their current AI infrastructure is obsolete and corporate data remains siloed. Security is a paramount concern due to past data breaches. Adherence to European Union (EU) data protection regulations, especially for emerging autonomous platforms, is critical.

Apigee for secure Auth, rate limiting, logging,etc

Apigee

Cloud Armor

Cloud Logging

KnightMotives plans to make significant investments in fully autonomous driving capabilities, with initial implementation targeting regions with favorable regulatory environments. Prioritizing employee upskilling, attracting top-tier talent, and fostering better communication between business and technical teams are also critical objectives.

Technical Requirements

The solution leverages Vertex AI platform to develop, deploy, and manage the AI models that power the new in-vehicle user experience. machine learning models required for the AI-powered features, such as natural language processing for voice commands or predictive analytics for driver assistance.

- **Modernizing the in-vehicle experience** includes developing a consistent user experience (UX) that seamlessly integrates AI-powered features across all models, updating in-vehicle hardware and software in legacy models to support new UX features and AI capabilities, and ensuring reliable network connectivity, especially in rural areas, to support real-time AI features and data transmission.
- **Network upgrades** are necessary to support increased data traffic and improve connectivity between plants and headquarters.
- **IT infrastructure modernization** requires adopting a hybrid cloud strategy to leverage the benefits of both on-premises and cloud infrastructure, and gradually modernizing or replacing legacy systems to improve efficiency and agility.

Anthos GKE on prem and GKE on cloud

1) Create a VPC network to provide a secure and isolated network environment for your Google Cloud resources
2) Set up Network Connectivity Center as the central hub for managing all your network connections.
3) Utilize Cloud Connectivity options, such as Cloud VPN or Cloud Interconnect, to establish secure connections between your manufacturing plants, headquarters, and the Network Connectivity Center hub.
4) Integrate SD-WAN/Router Appliances for rural areas

use Cloud NAT to provide internet access to private instances

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Utilize Vertex AI platform to develop, train, and manage the machine learning models required for autonomous vehicle perception, decision-making, and control.
Accelerate model training: Leverage Cloud TPUs within Vertex AI platform to significantly accelerate the training of large and complex deep learning models, such as those used for object detection, sensor fusion, and predictive control in autonomous vehicles.

Vertex AI and Cloud TPUs

- **Autonomous vehicle development and testing** requires investing in cutting-edge AI and machine learning technologies, building a robust simulation environment, and ensuring compliance with evolving regulations related to autonomous vehicles.
- **Data monetization and insights** requires implementing a robust data management platform, strict data security and privacy measures, and a scalable AI/ML infrastructure.
- **Increased focus on security and risk management** involves implementing a comprehensive security framework to protect against cyber threats and data breaches, developing an incident response plan, and providing security awareness training to employees.
- **Providing a delightful experience for dealers and customers** requires improving the online build-to-order system; developing modern dealer tools to streamline dealer operations, including sales, service, and inventory management; and implementing a comprehensive Customer Relationship Management (CRM) system to track customer interactions, personalize experiences, and improve customer satisfaction.

Apigee : Data monetizatio n

Set up BigQuery to ingest, store, and manage large datasets, forming the central data warehouse for all analytics and AI/ML

Implement data privacy and security with Sensitive Data Protection:

Leverage Google Threat Intelligence, Mandiant Consulting Services,Mandiant Incident Response Services

Conversational Agents , Agent Assist, Conversational Insights

Executive Statement

KnightMotives is committed to enhancing safety and saving lives by leveraging an extensive body of data—encompassing driving, road conditions, behavioral studies, and crash safety statistics—to create compelling digital experiences for drivers. Our AI consistently outperforms national safety statistics, ensuring the unique and coveted KnightMotives experience is aligned across all our vehicle models.

Michael Knight, KnightMotives CEO

Implement Conversational Agents for customer and dealer self-service:
Integrate Agent Assist for human agents: Equip dealer and customer service agents with Agent Assist to provide real-time recommendations, step-by-step guidance, and knowledge base lookups during interactions. This will improve response times and consistency.
Utilize Conversational Insights for performance analysis: Collect and analyze interaction data from both virtual and human agent conversations using Conversational Insights. This will help identify common pain points, agent performance trends, and areas

Use Cloud Functions to trigger actions based on conversational events, such as updating CRM records after a successful interaction or sending notifications for specific order statuses.

Sample Question 2: KnightMotives wants to provide select vehicle data (like maintenance alerts) to external partner companies via APIs, without giving direct access to internal systems. What is the best approach?
A. Use an API gateway (Apigee) in front of a controlled subset of the data, enforcing partner-specific credentials and rate limits, so partners can only access permitted data through REST APIs.
B. Give each partner a restricted BigQuery view of the entire telemetry dataset and let them query it directly with their own BigQuery accounts.
C. Set up a shared SFTP server where nightly exports of relevant data are uploaded as files that partners can download.
D. Create a VPC Network Peering connection to each partner's network and allow them to query the production databases via read-only accounts over the private link.

Answer 2: A. An Apigee API gateway lets KnightMotives securely share specific data with partners via managed APIs. B and D would expose too much internal data, and C (SFTP file transfers) is not real-time or convenient.