Edge Based Data Collection & Analytics for Real-Time Vehicle Logistics

/Abstract

Industry 4.0 Digital Transformation is just beginning to take hold globally. Some of the major challenges in launching these transformation projects are network connectivity, available computing resources, and the cost of upgrading existing infrastructure.

In this paper, you will learn how HarperDB helped a vehicle tracking solutions provider overcome these common Industry 4.0 challenges with a uniquely effective solution. Using HarperDB as the foundational component of the solution allowed for real-time route optimization and event alerting independent of the cloud, while running on existing computing hardware within the vehicle.

This was critically important in an environment with intermittent network availability, as HarperDB was able to provide reliability in an unreliable environment using limited computing power. These factors led the customer to realizing a path towards reduced costs, increased efficiency, improved safety and compliance, and increased revenues.

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/ Introduction

In late 2018, a partnership of a transportation supply chain logistics company from India and HarperDB resulted in a technical proof of concept, unique to the industry in how mobile IoT data is collected, processed, and consumed. This document gives an overview of that proof of concept as well as provide current and prospective clients an understanding of this shared vision of how the next generation of mobile IoT can be achieved.

/ Customer: Market Leader in Shipping Logistics for the Indian Market

This organization is the premier supplier of vehicle tracking solutions for corporate shippers and transporters in the Indian market. The company provides asset management and intelligent tracking solutions using a combination of high availability GPS-GPRS, custom in-vehicle controllers, and video monitoring. They offer bespoke reporting to their client base using mobile and web-based applications to support route tracking, planning, and logistics. The company operates a robust support network within India with 40 service locations and 200 highway partners, with many clients utilizing their solutions for more than 10 years. As their client base has grown and become more sophisticated, the reporting and analysis requirements have expanded significantly, putting a strain on their current systems. To remain the leader in the market and meet these increasing client needs, they began the process of redesigning their systems to take advantage of advances in IoT technologies. One of their main areas of focus was improving the overall data flow through the system from the thousands of vehicles to the datacenter and providing actionable intelligence to the end user. Their existing data architecture relies on a modern, but traditional relational database which was becoming difficult and expensive to maintain and scale.

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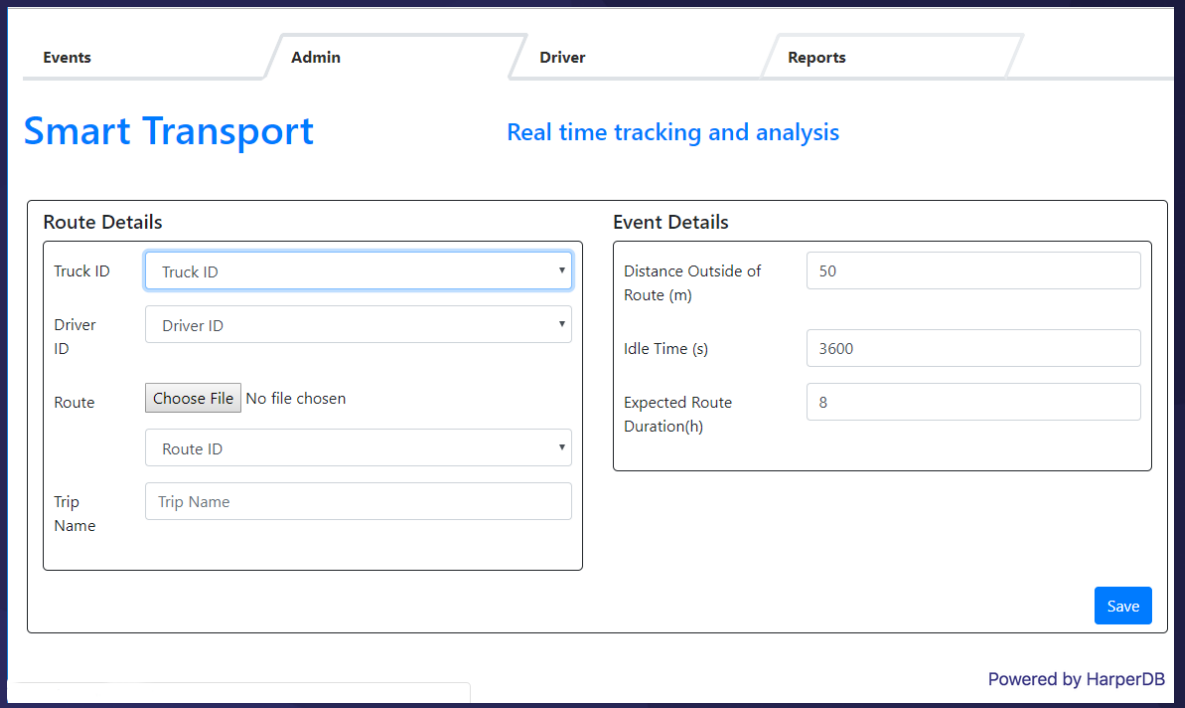
/The Challenge

The customer identified that their current database architecture would not effectively support the growing volume of real-time data while maintaining the performance standards for their clients, without significantly increasing their costs by scaling their centralized computing environment. Furthermore, their ability to make decisions on the edge was limited by intermittent network connectivity. Attempting to deploy their existing solutions to the edge was impractical, as the compute requirements were too high to justify the cost.

They realized that storing, processing and analyzing high frequency sensor data from a large and growing fleet of vehicles was a different problem than what traditional databases were designed to solve. Using traditional database architectures lacked both real-time and offline decision-making capabilities while significantly increasing cloud storage and compute costs.

/The Solution: HarperDB Mobile IoT

In late 2018, a transportation supply chain logistics company from India partnered with HarperDB Inc. of Denver, Colorado to implement the HarperDB Enterprise IoT Database in a proof of concept.



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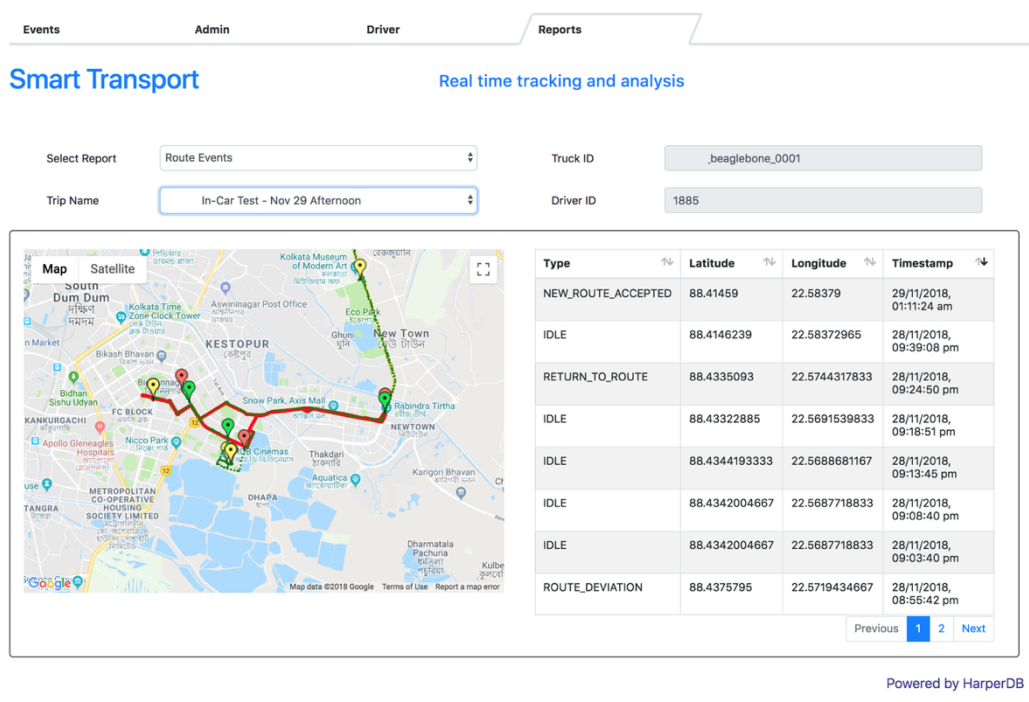

The team developed a prototype system to validate the capability for real-time data collection on mobile assets, and real-time reporting of the resulting data.

The goals of the proof of concept were to demonstrate the throughput of data from collection to reporting and perform both data collection and analysis directly on-device—reducing latency and cloud computing costs. The solution included installing the HarperDB Device Edition on existing in-vehicle hardware which performed real-time GPS and event data synchronization to the cloud.

The in-vehicle systems included microcomputers connected to video and GPS with GSM capability for communications. A web application was developed which provided real-time route updates and event notifications demonstrating the ability to provide real-time reporting.

Data collection was completed over a two-day period in India where the onboard system was installed in a vehicle and driven around the city. A planned route was developed using common Internet mapping tools and uploaded to the web application prior to the trip. The proof of concept application was built to track the location of the vehicle and generate alerts when the driven route deviated from the planned route in distance or idle time. These alerts were computed onboard the vehicle in real-time and could be directly sent to clients or company dispatch immediately through SMS. All raw GPS strings and events were stored in the HarperDB Device Edition until they were successfully replicated to the cloud.

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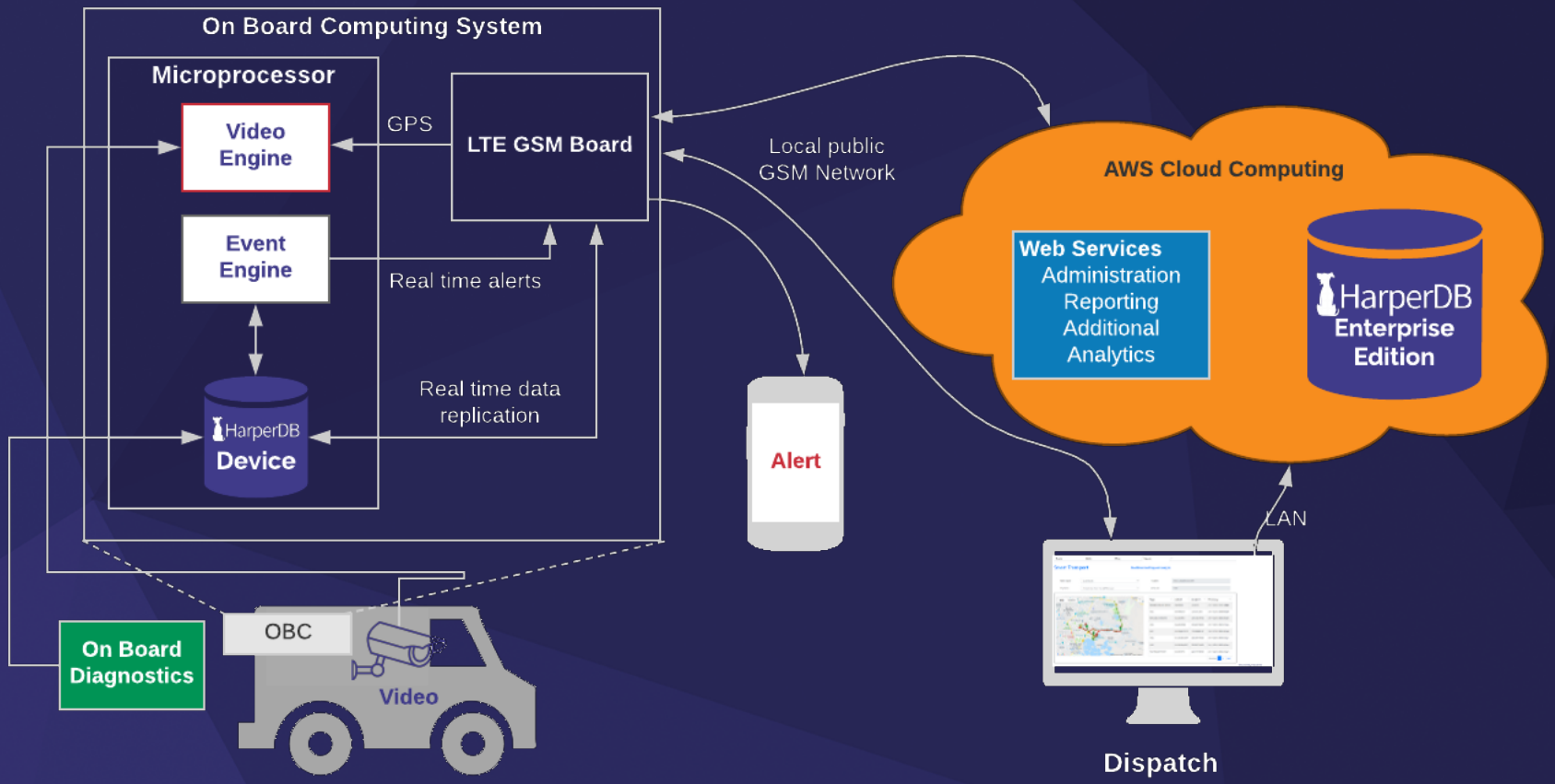
The real-time clustering of HarperDB provided the native ability to synchronize data from device to the cloud, allowing for instant access of the data for reporting. As data transfer relied on local GSM networks, the persistence of data in HarperDB on-device meant that data could be stored on-device when the network was not available. As soon as the connection was re-established, data was automatically synchronized to the cloud without data loss with HarperDB's built-in clustering and replication. Since the same database and event engine run both on the edge and the cloud, an event was generated in the cloud database when no data was received from a device within a specified amount of time.



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"Our team has unanimously agreed that HarperDB works well and can be leveraged for real-time decisioning. The integration of HarperDB could be the real accelerator we need to supercharge our client delivery."

Customer Company Chief Operating Officer

/Summary

The result of this proof of concept provided valuable insights into the mobile IoT problem. The ability to run HarperDB on microcomputers running on the edge provides a long-term path to a distributed and peer-to-peer environment with lower latency and costs. As with any new technology adoption, progress occurs in phases. Adopting peer-to-peer mobile IT solutions requires additional design and testing when considering the impact to the underlying onboard devices, as the organization supports additional sensors and capabilities for their clients. The implementation of HarperDB as a pure cloud IoT database provides a next step with the ultimate goal of distributing the data collection, processing, and reporting in the future.

The proof of concept validated that high frequency data can be collected, processed and synchronized to the cloud in real-time via mobile microcomputers. All organizations involved in the proof of concept have a better understanding of streamlining mobile IoT data collection, analysis and reporting processes, and optimization of costs, while maintaining a consistent client experience. The result requires a shift from traditional relational or unstructured database strategies to technologies developed specifically for high throughput in environments where network connectivity is not assured 100% of the time.

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