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VIRTUAL BIG DATA SOLUTION ROI FLEXIBLE DATA DRIVEN

WHITE PAPER

The Internet on Wheels and Hitachi, Ltd.

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Executive Summary

The “connected car” is part of our increasingly connected world of people, machines and a growing number of “things.” The concept and its potential automotive applications open up possibilities that foretell the most significant industry revolution since cars displaced the horse and buggy on roads close to 100 years ago. Today, with over 1 billion vehicles globally and an expected 48% annual growth of electric vehicle sales until 2020, the “Internet on Wheels” has also become a significant component of the Internet of Things.

Introduction

The adoption of connected cars is evidence of a market demand for ubiquitous communications and a wider scope of services. The market for these cars is also built on the revenue opportunities created by new regulations, such as eCall in Europe. This initiative dictates that all vehicles manufactured from 2015 forward come equipped from the factory with a SIM card capable of communicating with emergency teams in case of an accident. By 2016, over 1/3 of all circulating cars in Western Europe are expected to be connected, reaching about 90% by 2020. Cars and other vehicles will communicate with each other as well as with the social infrastructure, such as road signs, bridges and electric grids, improving the overall driving experience. At the same time, they will assist in reducing or even eliminating traffic accidents and their tragic consequences.

An example of the standardization effort among European automobile manufacturers is Cooperative Intelligent Transport Systems (C-ITS), which was created to improve road safety, traffic efficiency and sustainable applications. Such communication ecosystems can only be developed through partnerships between automobile manufacturers, insurers, technology suppliers, telecommunication providers and public authorities. This ecosystem will be the foundation for a wider range of in-vehicle services, potential savings for manufacturers, consumers and governments, as well as a path to improved safety and sustainable mobility for the growing global population. Smart cities and self-driven cars, expected in the not-so-distant future, are elements of the social innovation required to face the challenges and pressures of the present, and to create conditions for achieving a better, sustainable world for generations to come.

The Undeniable Value of Data

The amount of structured and unstructured data created by connected vehicles, as well as this data's different sources and complexity are an example of a big data problem. Solving this problem is about generating value, and this value goes far beyond its financial component. The value generated is aimed at creating an improved, sustainable world through social innovation that drives bigger and better outcomes for societies as a whole. Companies in every industry have realized that data should be considered a valuable asset, rather than just a storage necessity with its associated costs.

The Internet of Things enables completely new business models as well as the refinement of existing ones. The data generated from dozens of sensors installed on each vehicle will keep growing exponentially as more suppliers fit their components with additional sensors. Today, the amount of data generated by a connected vehicle exceeds 25GB/hour. More value will be extracted as manufacturers look beyond the boundaries of their companies and combine different sources of data to provide an even better and stronger context to the data available in-house. Combining this data with other sources of data, such as demographics, weather and social media, can open up a wide and much deeper range of possibilities. Big data is about big value. Analyzing this data is not so much a question of which technologies to use, but rather about which business problems need to be addressed, and how.

Understanding what drives value in a business is the first step to harnessing big data's value through the insights its analysis reveals. Value is unlocked by a deeper understanding of an organization internally and externally, of its suppliers and customers. Automobile manufacturers have an abundance of value to capture by actively managing the data and unlocking its potential. Creating, processing, analyzing and visualizing data in real time will continue to be business-critical. These actions assist in business decision-making from a new perspective necessary to compete, and to deliver on big data's promises of higher top-line revenues and efficiency gains.

The Smart Car as a Communications Hub

A typical American commuter spends nearly 250 hours per year inside their car. Adding personal use to this total, it is clear that a great deal of time is spent inside their vehicles. In the new age of constant communications, consumers want to enjoy all (and if possible more) of the same services they access at home, at the office or anywhere else using their smart phones, tablets and so forth.

Car connectivity and the value-added services it enables are key buying decision factors when consumers select their next vehicle. In a recent study by the University of Michigan, 86% of the respondents expressed interest in connected cars. Nearly half of the car buyers already wish to access their mobile applications when they are inside their cars. Connected services and content rich/user-friendly infotainment onboard platforms are increasingly important factors when making buying decisions for the next vehicle. Car buyers are also interested in smart services, such as the diagnostics that predict problems and alert drivers to the need of a repair or a replacement of components. Hitachi, Ltd., is responding to this demand with innovations in car infotainment systems and connected smart cloud services, such as our work with Clarion Smart Access. Smart Access is a flexible, integrated, cloud-based content management and policy control platform that enables drivers to safely define, customize and control their unique connected car experience. The Big Data Lab at Hitachi is already partnering with major global telecommunications providers as well as Internet giants to provide a clear differentiating experience, including the integration with the social infrastructure of tomorrow.

Combining the connected car, the data it generates and big data analytics allows automobile manufacturers to shift from a reactive mode to proactive intelligence in business decision-making. This approach will frequently be the difference between a winning organization and one that loses to the competition.

Services. Savings. Safety and Sustainability.

Services as a Key Buying Decision Point

Automobile manufacturers have long understood that the relationship with their customers must be monitored and nurtured closely. A new generation of buyers increasingly opts for leasing contracts and for vehicle sharing. This trend brings new challenges in securing customer preferences over the longer term, but it also creates room for innovative approaches in dealing with consumers. Big data helps manufacturers understand what consumers want and how they behave.

Sentiment analysis from social media used inside and outside the vehicle enriches the possibilities of customer relationship management to unprecedented levels of depth and detail. This analysis provides a better understanding of consumers and enables conversion of these insights into sales growth and improved brand perception in the market. These results are essential to establishing and securing brand loyalty; they are a key input for the development of the new features, products and services that will drive revenue growth. This knowledge also enables automobile manufacturers to deliver vehicles and services better, faster and more efficiently. They will continue to differentiate through analytics-powered products and services. Big data analytics on the data gathered as to how cars are used, and its incorporation into the business decisions, creates both a source of competitive advantage and a platform for innovation.

An average car today contains more than 20,000 components. While developments in mechanics and other engineering fields in the auto industry are remarkable, it is the electronics field that has been gaining tremendous relevance and impact on vehicle performance over the years. The electronics of a midrange car

already account for about 1/3 of a vehicle's total cost. Vehicles have about 40 microprocessors and dozens of sensors. The high availability of sensors opens up new possibilities. These sensors collect telematics and driver behavior data that can and should be analyzed. Real-time analysis is accompanied by command and control of a vehicle's performance, efficiency and safety.

The ability to gather data about how car parts are used on the road, how the driver is using the car, and the services provided, together with feeding back this data for analysis, facilitates general improvements. These enhancements are seen in: 1) the vehicle's performance, 2) the development of new versions of the vehicle, 3) the existing services, and 4) the generation of new services. This capability is becoming a competitive advantage for automobile manufacturers that can unlock the insights from the data. This is why they must reach out for partners to assist them in several new fields, including connectivity, big data and analytics, as these are areas beyond the traditional auto industry's core business.

For automobile manufacturers to generate data-driven innovative products and services, a platform that includes the necessary technologies and processes must be put in place. It must also be supported by new competencies of its human resources. Hitachi Data Systems and Hitachi Consulting work together in helping organizations design and implement these organizational changes, partnering with businesses to define, co-develop and implement integrated, efficient and scalable solutions.

Savings

Insights from big data analytics can be applied in organizations to steer research and development activities and to optimize production. Once the new products and services are launched, big data analytics allows organizations to optimize their cost production and determine the necessary improvements. Automobile manufacturers can also achieve significant efficiency gains in their research and development activities by better understanding how vehicles are used, how their performance and different components can be improved, and what consumers expect.

Big data analytics can be used to reduce the time required to carry out specific processes within organizations, such as the ones related to manufacturing. A major German automobile manufacturer achieved a 20% boost in productivity by using predictive analysis for its production line, mitigating the production disruptions that occurred due to the assembly line's machine failures.

Fuel consumption continues to be a key feature that buyers look into when purchasing a vehicle. The real-time recommendation of the best route, the interaction of all vehicle components "talking" to each other to optimize the driving experience, and the optimal fit with the road conditions, all contribute to boosting fuel economy.

Consumers are beginning to understand that they can save with usage-based insurance. Over 40% of consumers would potentially be interested in this type of offering. To gain traction in the adoption of this service, consumers need to see the benefit from a cost point of view. However, they also need to be reassured of their data's protection. While consumers are suspicious about the utilization of their personal data, there are plenty of examples indicating that they are willing to provide some data if they get a benefit from the resulting services that they can use.

Authorities can also target drivers with specific taxes for utilization of the social infrastructure based on their usage pattern. This could provide a more balanced system in which more utilization would result in higher

payments, while people owning vehicles but using them less frequently would accordingly receive a tax benefit or other incentives.

Safety and Sustainability

The combination of connected cars and big data analytics is part of the recipe for solutions that support safety and environmental efficiency. These solutions need to be integrated through control systems between the connected vehicles and the social infrastructure. This integration will allow accident prevention and greater control of dangerous situations. Reports indicate that 75% of consumers believe connected cars may reduce the number and seriousness of road accidents. Connected cars and particularly the new eCall regulation in the EU, have the potential to improve the response times and effectiveness of emergency teams. In the U.S., over 10,000 fatalities and as many as 500,000 injuries may be avoided yearly with a mature connected ecosystem in place.

Big data can help save lives, using real-time analysis of the weather, traffic and road conditions, as well as information such as the vehicle's condition and speed, and the drivers' behavior (if it is not a self-driven vehicle). But the collection, management and analysis of data towards improving safety are sensitive points. This function must be resilient and executed in real time if it is to provide the expected safety benefits. Otherwise, it may have the opposite effect. Over 80% of respondents in a recent study selected safety as the most important benefit resulting from connected cars.

Detecting that an engine may break down based on the temperature, the vibrations and the sound it produces allows fleet managers to reduce the downtime of their vehicles. It also may help drivers avoid being stuck far from assistance in the middle of the night. Further, predictive maintenance contributes to reducing the consumption levels of fuel-, hybrid- or electric-powered vehicles. Route optimization is a way not only to save time, but also to reduce consumption. While some of these systems are starting to emerge on higher-end vehicles, the generalized adoption of these solutions will make this commonly available in all vehicles. The data generated by cars and their users, within the Internet on Wheels, provides important insights that will influence how smart cities are built and managed in the future.

Communication between the connected car and the electric grid is the key to creating an ecosystem where electric vehicles can be charged without endangering the electric network by overloading it. Hitachi builds power plants, wind turbines and other power systems populated with thousands of sensors that generate huge amounts of data. This information is managed and analyzed for optimal safety and maximum efficiency of these complex energy systems. Hitachi Automotive Systems, Ltd., also provides battery systems and a wide range of sensors for electric vehicles of major European and Japanese manufacturers. Advanced driver assistance systems, such as G-Vectoring Control from Hitachi, are milestones toward making autonomous driving a reality, while emulating the human driver's behavior in order for this new paradigm to gain acceptance in the market.

In the social innovation area, several pilots are currently underway in Europe and elsewhere for electric vehicle charging stations that can be fully integrated with the social infrastructure of smart cities. They contribute to preserving the cities and making them more efficient, and thus more environmentally friendly.

**Big Data
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Hitachi, Ltd., a Shared Vision

In the digital world, Hitachi builds the IT hardware and software to capture, manage and analyze big data, and turn it into insights that generate business advantage. Unlike other technology vendors, we have machine data in our DNA: We build the machines and the social infrastructure that produce big data. Building machines that communicate between each other, linking disparate data sources, and using the collective knowledge they contain is something Hitachi has been doing for decades.

At Hitachi, we believe that a common vision should be implemented to maximize the benefits of the Internet on Wheels. Internally, different Hitachi divisions work together toward achieving the vision of smart cars as part of a social infrastructure fueled by innovation. Social innovation fosters an expectation that the ultimate goal of technology innovation lies well beyond shareholder value and stock prices. It suggests a concern for the improvement of society.

Privacy

Car buyers want to use connected services and be safer on the road, but they are concerned with data protection and privacy. Automobile manufacturers should safeguard consumers' rights in their connected services offering. For example, they need to find the balance between providing all the benefits brought by connected vehicles and infrastructure while addressing the consumer's concerns. Critical data must be protected from hackers and others with criminal intentions. Attacks from criminals could in fact confuse and scare consumers. Attacks could jeopardize the advantages that the connected services bring, therefore slowing down or even threatening the evolution of this key social innovation component. Hitachi works closely with public entities, such as the European Commission, the European Telecommunications Standards Institute (ETSI) and European Committee for Standardization (CEN) to define the necessary technology standards and actively participate in the debate about data ownership, data protection and consumer rights.

Hitachi and Automobile Manufacturers

Hybrid cars generate up to 25GB of data per hour. This number is 10-fold for test cars, which are equipped with cameras and additional sensors. With this amount of data, an infrastructure needs to be in place that can ingest, store, manage, analyze and provide visualization of the billions of data points generated by sensors and other unstructured data sources.

Hitachi Data Systems provides the IT infrastructure, both physical and cloud-based, and a vertically integrated stack around big data and analytics that brings tangible value, reflected in top-line revenue and efficiency gains. Through the innovative research being conducted in its Big Data Lab, Hitachi is building the expertise and platforms to turn big data into big value. With a track record and continued research in automotive and infotainment systems, energy management and many other areas of social innovation, Hitachi is in a unique leadership position to make these societal improvements a reality.

Automobile manufacturers are building their in-house data-analysis teams but need to continue to work with external technology vendors to uncover the insights from the data. These partnerships will allow them to reap more value and to do it faster, while securing for themselves the bulk of the resulting profits. They have a choice between storing and analyzing all data in-house or investing in external data storage, management and analysis by partnering with a technology supplier.

The automobile industry is being reshaped by big data and the Internet of Things. For business leaders in the industry, this is the moment for making strategic decisions about big data and how it will transform their organizations. Hitachi can assist automobile manufacturers in shaping the views of stakeholders and developing a big data strategy. We can help you design and implement solutions that maximize the potential value of big data, translate it into actions that bring tangible gains, and deliver the competitive edge needed to win in the industry.

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