

Connected Vehicles

From Building Cars to Selling Personal Travel Time Well-Spent

Authors

Andreas Mai
Dirk Schlesinger

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The idea of connecting vehicles is gaining momentum. Many stakeholders intuitively see the benefits of connecting vehicles and have started to develop business cases for their respective domains, including the automotive and insurance industries, government, and service providers. This paper is part of a series of Points of View from Cisco's Internet Business Solutions Group (IBSG) analyzing the business case for connected vehicles from all of these perspectives.¹ The series explores the broad societal and business costs of current models of personal transportation, and how connected vehicles can create new value while transforming outdated approaches. In this paper, we discuss how automotive manufacturers can reduce the cost of serving their customers and tap new revenue pools by connecting vehicles on a unified communications platform.

Aging Business Model Meets Modern Customers

The 20th century was the age of the automobile, a \$1.5 trillion global industry that has become one of the most important sectors in leading economies. Yet, since Henry Ford invented the assembly line nearly a century ago, little has fundamentally changed in the way auto companies build and sell cars. Today, despite the recent focus on fuel efficiency, the vast majority of vehicles continue to be overbuilt and underused, causing shrinking profits for the auto industry.

Over the past decade, most automotive manufacturers generated gross margins of 8 to 15 percent. This was hardly enough to secure a sustainable net profit in a business where manufacturers bet three to five years and \$1 billion to develop a successful new vehicle pipeline. And while no automotive manufacturer has come up with a fundamentally new business model for selling personal vehicles, it is clear that no mature player wants to push price competition anymore.

Vehicle design, technological features, and marketing tools now dominate the automotive manufacturing landscape. So far, the playing field has been relatively level: no single manufacturer has benefited from game-changing differentiation. Year after year, manufacturers show off ever more futuristic "halo cars," many of which never make it to production. Or if a company introduces "breakthrough" technologies in one model year, other manufacturers commoditize the same advancements the next year. Industry players have competed with the same tools for decades, without truly bringing anything new to the game. Even marketing cars via social media has become mainstream, rather than representing anything truly transformational.

From Personal Mobility to Personalization

Today, the value system of personal mobility is under attack by a new generation of drivers that cherishes social media and technology more than a car. A recent study in the car stronghold of Germany found that 75 percent of people aged 20 to 29 had a driver's license, but 45 percent of those "rarely drive a car." Eighty percent even stated that they would not even want to own a car in cities that have public transportation. Japan, another car-centric country, has a name for this trend: *kuruma banare*, which translates "de-motorization." Another recent German study found

that nine out of 10 people 14 to 29 years old could not imagine a life without a mobile phone, but could live without a car.²

This is scary news for an industry whose products have typically represented the second-largest expense (after home purchases) for an average household over the last century. It is no longer enough to sell personal transportation; people want a personalized driving experience that keeps them connected to everything that is important to them—friends, information, music, maps, schedules, and more.

Suppose the automotive industry could build on what smartphones did for the phone industry? Cars would turn into “personal digital assistants (PDAs) on wheels,” with the potential to become an even more personal gadget than any smartphone or tablet PC. They would enable drivers to take all their “soft” personal preferences, features, and media-access options with them on the road. Hyundai is heading in this direction by adding an iPad to every new Equus sold in the United States, and through a recently announced tablet PC collaboration with Samsung.

Let’s assume that every car would come with a mobile device that is seamlessly paired with the vehicle’s human-machine interface (HMI). The PDA or tablet PC would be preloaded with an interactive manual and car applications. Owners would gain convenient access to a range of services from their PDA or from inside the vehicle “at the push of a button”: interactive manual with videos and escalation to a live agent; vehicle information and health monitoring; maintenance and service appointments; price scouts for local gasoline or charging stations; emergency notifications; and driver health and safety monitoring, possibly in cooperation with emerging insurance models such as mileage-based pay-as-you-drive (PAYD) and behavior-based pay-how-you-drive (PHYD) programs.

As promising as many of these opportunities are, automotive manufacturers will need to control driver distraction and ensure secure communication in their vehicles. Seamlessly integrating nomadic devices is a good first step, but eventually, a factory-installed unified communications platform will become standard in every vehicle.

Next-generation drivers are information and multitasking addicts. Drivers want to be connected to their friends via SMS, Twitter, and Facebook; they want information about the most efficient route, the lowest gas prices, and the best restaurants. The ability to deliver this information inside a moving vehicle is becoming increasingly important for auto manufacturers. The policies that control which information or applications are allowed in a vehicle, how they are integrated into vehicle ergonomics and acoustics, and how users interact with them will not only enhance the in-vehicle experience, but for easily distracted drivers, may spell the difference between life and death. Automotive manufacturers will need to control the entire platform, as they hold ultimate responsibility for the safety of their products and services.

Integration of advanced driver assist systems (ADAS) with vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication holds the promise of reducing 80 percent of crashes.³ Nomadic devices lack the low latency, connection continuity, and security necessary to ensure that the vehicle’s ADAS receive potentially life-saving impulses at a low risk of interruption or intrusion.

While it may take another five to 10 years for this life-saving technology to take to the road, a recent study, “Experimental Security Analysis of Modern Automobiles,” uncovered significant security vulnerabilities in current vehicle communication networks. These issues have catapulted

secure communication with in-vehicle systems to the top of the agenda of automotive electrical and electronics engineers.⁴

Based on these trends, Cisco IBSG sees a convergence to a factory-installed unified vehicle communication platform to manage safe in-vehicle communication, securely connect the vehicle to the outside world, and seamlessly integrate nomadic devices into the vehicle's HMI.

Creating Cars with Portable Personalities

A car is far more versatile than a mobile device, so it is likely that future cars will contain even more valuable “soft” personal preferences, features, and media access than our smartphones do today. Combining these “smart cars” with vehicle connectivity and pervasive computing has the potential to change the game in value creation and client retention for automotive manufacturers forever.

Pervasive computing comprises the idea that almost anything—from clothing, to tools, to appliances, to cars, to homes, to the human body, to your coffee mug—can be implanted with chips to connect to an almost infinite network of devices. The goal of pervasive computing is to create an environment where connectivity is unobtrusive and always available. Pervasive computing combines current network technologies with wireless computing, voice recognition, Internet capability, and artificial intelligence.⁵

Using this evolution of network technology, car manufacturers could take the personalization concept to the next level and create cars with personality. “KITT,” from the 1980s TV series “Knight Rider,” and more recently “Eve,” from the movie “Wall-E,” have impressively demonstrated the marketable appeal of technology with “personality.”

Stanford University Professor Clifford Nass is working on the next-generation HMI, through which many mechanical car functions will be voice-controlled. According to Nass, voice is at the heart of human interaction. For example, one of the first things babies recognize after they are born is the voices of their parents. Hence, the more we deploy voice control in vehicles, the higher the probability that we will get emotionally attached to our vehicles.⁶

Additionally, future cars will be able to compensate for our strengths and weaknesses, to learn our preferences, to sense their surroundings, and to access the “Internet of Things.” Using these capabilities, cars have the potential to become helpers that augment our driving capabilities and make our travel experience safer and more convenient. Figure 1 illustrates some ideas about what could be accomplished by combining vehicle connectivity and pervasive computing.

Figure 1. Use Cases for Connected Vehicle + Pervasive Computing.



Source: Cisco IBSG, 2010

All these personalized capabilities would make a traffic accident an even more traumatic experience: you could potentially lose not only a valuable vehicle, but also all of your personal preferences, features, and lessons from years of driving your car. The “personality” of the car might even become more important than the physical shell in which it is housed.

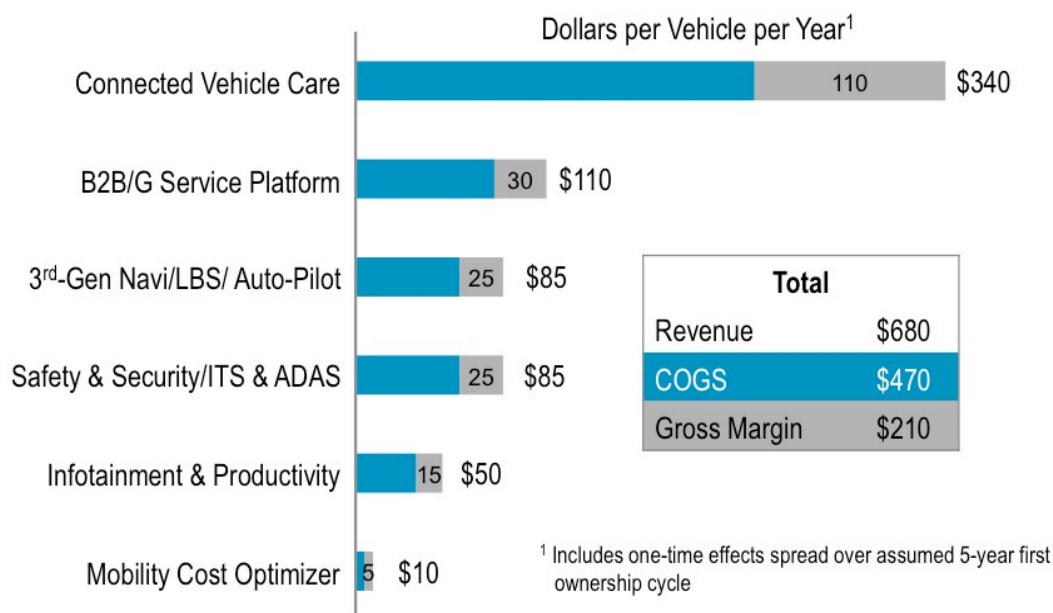
Consequently, portability of your vehicle’s personality would become important and constitute yet another value-add car companies could offer. With the car’s personality residing in the cloud, you would be able to infuse it—perhaps via your PDA or tablet PC—into any vehicle you choose to own, rent, share, or drive.

Ubiquitous connectivity of vehicles not only allows car manufacturers to ride the wave of smart mobile devices, but also enables a fundamental strategy shift *from building cars to selling personal travel time well-spent*.

Emergence of the Connected Travel Experience Value Chain

After a car is sold, automotive manufacturers have paid little attention to revenue generated by fuel or energy, insurance, parking, car rental, or value-added vehicle ownership and travel services. The advent of vehicle connectivity opens a currently untapped treasure chest of new profit pools, and completely new service and pricing options for automotive manufacturers (see Figure 2).

Figure 2. Value-Add of Vehicle Connectivity.



Source: Cisco IBSG, 2010

Connectivity enables flexible, new service options, with estimated revenue potential of \$680 per vehicle per year, and gross margin potential of \$210 for automotive manufacturers and dealers. This is based on estimates for more than 50 potential connected vehicle profit pools after applying conservative acceptance rates that average about 18 percent. Providing basic connectivity with a prepaid plan could secure more than half of this potential.

Starting with the most valuable service for automotive manufacturers, **Connected Vehicle Care** constitutes \$110 in gross margin per vehicle per year. Connectivity provides a direct link to vehicles and their owners, opening new ways to improve the ownership experience. Automotive manufacturers can offer tiered vehicle health coaching services ranging from virtual onboard assistance to remote life assistance (ability to speak with a real person who is remote). Sensor-based service, maintenance alerts, and onboard scheduling of service appointments, combined with coupons, will lead to higher service retention and profits. At the same time, the cost to serve will decrease as remote diagnostics and prognostics allow faster detection of quality issues and enable remote flash updates for car electronics, which account for 35 percent to 50 percent of a vehicle's value and more than half of today's vehicle quality issues.⁷

A nascent but promising profit pool is **the business-to-business or business-to-government (B2B or B2G) service platform**, with an estimated gross margin potential of \$30 per vehicle per year. It comprises services for insurance companies, dealers, first responders, road and traffic managers, parking providers, and advertisers, to name just a few. Access, data, customer relationship management (CRM), and payment services for a captive audience of vehicle owners, drivers, and passengers on the road offer a multitude of opportunities for new business models.

Third-generation navigation, combined with location-based services (LBS) and augmented by autopilot functionality (after 2015), constitutes an estimated \$25 in annual gross margin potential per vehicle. It offers next-generation navigation, real-time traffic

guidance, eco-routing and driving support, and location-based services delivered on an integrated service interface. V2V and V2I communications are key enablers for autopilot functionality, which is maturing quickly and could become a high-end option toward the end of this decade. In 2010, Google demonstrated a driverless Prius; Audi climbed Pikes Peak without a driver; a driverless Fiat automobile traveled from Italy to Beijing; and a Volkswagen Passat mastered Wolfsburg, Germany's traffic without a driver.

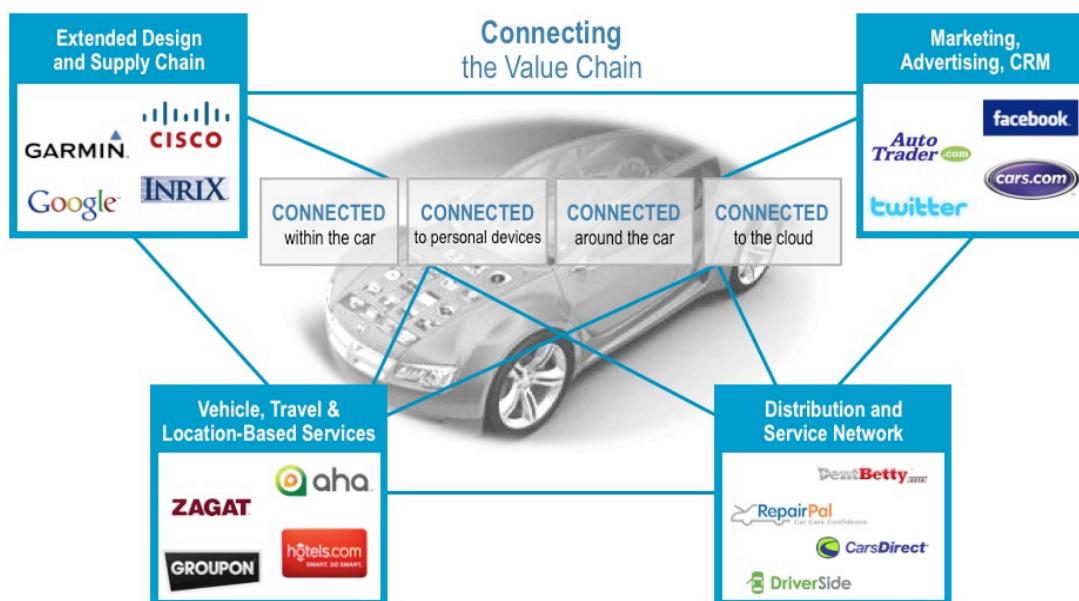
Connected safety and security represents another \$25 in gross margin potential per vehicle per year. In addition, integration of advanced driver assist systems with V2V and V2I communication has the potential to prevent 80 percent of reported crashes, according to a report by the National Highway Traffic Safety Administration.⁸ Cisco IBSG estimates the crash-related savings will average \$280 per vehicle per year—\$190 for the vehicle owner and another \$90 for the external societal cost of crashes.

Advanced crash and SOS notifications will soon become standard in all vehicles. Geo-fencing and the ability to monitor and possibly limit speed and drive time could provide added safety for families with new teenage drivers. These capabilities would require online monitoring by individual driver as well as by vehicle. Safety coaching would be the next evolution of service opportunities. These applications would monitor driver behavior; provide scores, recommendations, and, potentially, corrections, in combination with advanced driver assist systems; and then report the number of corrections and the value of prevented crashes. Comparing an individual's safety report with those of peers, conducting safe driver competitions, and providing incentives for safe driving (with emerging "pay how you drive" insurance premiums) would add even more value. Finally, the increasing number of older drivers will be interested in driver health monitoring that provides onboard alerts regarding a driver's vital signs, along with potentially allowing remote monitoring and transmission of critical health information immediately after a crash.

Interestingly, traditional **infotainment**, which takes center stage in some newer systems such as Ford's Sync or My Ford Touch, is becoming a commodity, with only \$15 in gross margin potential, even when complemented with productivity services such as vehicle-integrated voice, data, and conferencing services; synchronization of calendars and email; and social media applications. This is understandable, as users are reluctant to pay more for the same services they have already purchased from wireless and infotainment providers. The connected vehicle will become just another device to consume already purchased services. Ubiquitous connectivity of vehicles and cloud computing will eventually allow travelers to effortlessly access their personal media libraries at home, at the office, or from third-party service providers anywhere, and with any device.

Unlocking the above profit pools will depend on the ability to connect value-chain partners with vehicles, their owners, drivers, passengers, and the mobile devices they bring onboard. A car company alone cannot deliver on the promise of connected travel experience: game-changers will connect their value chain (see Figure 3) and orchestrate value-added partners to deliver a compelling set of new services and pricing options to vehicle users and business partners alike.

Figure 3. Connecting Vehicles with the Automotive Value Chain.



Source: Cisco IBSG, 2011

Connectivity Enables Innovative, New Business Models

In addition to enabling new services, connectivity will offer the flexibility to move from rigid, bundled packages to services on-demand, and will also allow completely new pricing models such as micropayments on a per-feature, per-use, per-mile, or per-minute basis.

Zipcar, iCarpool, CarBuddy, Zingo Taxi, and car2go are stellar examples of how the dwindling desire to own a car, combined with services enabled by vehicle connectivity, is creating new business models for car sharing and on-demand driving. These new mobility service providers advertise that one vehicle can cover the needs of up to 20 users who, in return, benefit from annual savings of 20 to 30 percent, or \$2,000 to \$3,000, compared to owning a car.

While most of these mobility services are in market-test or early scale-up stages, they are precursors of a formidable competitor to incumbent business models of selling or leasing cars. If automotive incumbents can combine their financial clout with the innovations of new mobility service providers and the capabilities gained through vehicle connectivity, they can enable some truly disruptive offers. Subscribers or random customers could be given the option to swap cars as needed—yearly, quarterly, monthly, daily, hourly, or even by the trip.

“All inclusive for less” is an excellent example of a disruptive offer. Like cruise ships and tourist resorts that offer guests the “paradise effect” of having a good time at an all-inclusive price, automotive manufacturers could provide an all-inclusive vehicle ownership package at a lower cost than if owners bought the component pieces separately. Some manufacturers are already offering extended warranties and prices that include all service and maintenance. Just add packages for insurance, energy, and connected vehicle services—all purchased with the buying power of global car manufacturers—and we are one step closer to a “carefree” vehicle ownership experience at a lower cost. Manufacturers could also work with service providers to

offer a “free” basic voice and data plan, with the option to buy premium voice and data features with a click of a button.

“All-inclusive pay-as-you-drive for cash” offers an attractive opportunity to expand the above business models by connecting up to 750 million aftermarket vehicles on global roads. A new business unit, subsidiary, or partner of the automotive manufacturer would buy back existing vehicles for cash in return for connected vehicle services subscriptions. The vehicle would be retrofitted with an onboard unit providing many key features of connected vehicles. For giving up ownership of the vehicle, the driver would receive cash, enjoy the benefits and experience of vehicle connectivity, and benefit from a lower operating cost due to in-network volume discounts and subsidies of marketing and location-based service providers. This model would not only benefit individual drivers, but would also accelerate penetration of vehicle connectivity to reach the minimum 10 percent needed to yield the benefits of intelligent transportation systems.

Operators of connected vehicle fleets would enjoy incremental connectivity benefits, including lower fuel cost, increased vehicle utilization, reduced maintenance and repair, lower crash costs, and elimination of unauthorized vehicle use. They could also offer “connected fleet operations services” to other large fleet owners, such as car rental, trucking, delivery, or taxi companies.

Vehicle connectivity opens a potential cornucopia of online services for vehicle owners, drivers, and passengers. Preloaded apps would be available for free during a trial period, or as a basic version with the option to “click to purchase” after the trial period or to upgrade for premium services. Participating partners would pay for access to this new vehicle user customer base, and connected car manufacturers or fleet operators could emulate successful business models from the technology industry. For example, with “Google on wheels,”⁹ B2B advertising¹⁰ at vehicle start-up or shut-off could subsidize the costs of vehicle users. With an “app store on wheels,” partners could share profits of vehicle-related services, part of which could be used to subsidize the cost of driving the vehicle. In the spirit of freedom of choice, drivers who do not like this idea could simply opt-out and pay the usual price for driving a car or making a trip.

Launching a systemwide “EcoMiles” loyalty program would add yet another layer of value, enabling customers to earn benefits for every mile driven. They would get a report of all their benefits from driving a connected vehicle, including operating-cost savings, travel-time savings, and greenhouse-gas savings per trip, per year, or as an aggregate over the lifetime of the membership. To expand this business model, the EcoMiles operator could establish a “one-stop miles bank” for consumers, with exchange rates for all participating miles programs. This would provide many more options for customers to actually use their hard-earned miles and eventually eliminate the hassle of carrying around stacks of loyalty cards from airlines, hotels, retailers, restaurants, and credit card companies. The EcoMiles operator could also offer loyalty program operations as an outsourced service to other companies. In addition to advantages of scale, this strategy would provide customer relationship intelligence that goes far beyond what any single company loyalty program could provide.

Getting Started with a Connected Vehicle Strategy

Vehicle connectivity has the potential to transform the automotive industry. It allows manufacturers to expand the automotive value chain from building cars to selling travel time well-spent. The resulting \$210 gross margin for value-added services per vehicle per year adds a significant and recurring profit stream that makes automotive manufacturers less dependent on profits from vehicle sales.

Automotive manufacturers can secure more than half of this value by selling vehicles with a prepaid plan for connectivity. Enabled by the same connectivity, the other half can be monetized with new business models and a host of new services. To capture this value, automotive manufacturers will need to connect their value chain with partners such as wireless service providers, insurance companies, government agencies operating intelligent traffic systems (ITS), fleet operators, emerging businesses like car sharing, and providers of context-relevant and location-based services.

The potential to prevent 80 percent of crashes and to reduce the associated cost by at least \$280 per connected vehicle per year will eventually lead to mandated integration of low-latency V2V and V2I communication with ADAS and ITS, possibly toward the end of this decade. The resulting capabilities will bring automotive manufacturers a step closer to realizing the vision of self-driven vehicles.

While creating cars with a portable “personality” is admittedly a futuristic concept, rapid advances in virtual intelligence make it worthwhile to start exploring this next-generation approach. Enhancing the experience of owning and traveling in a vehicle is the new battleground for the automotive industry, with far more potential for delivering value and creating differentiation than most improvements in propulsion technology, vehicle design, marketing, or pricing.

Services that deliver the greatest added value will rely on a factory-installed unified communications platform with automotive manufacturer-controlled policies to manage safe in-vehicle communication, securely connect the vehicle and its electronics architecture to the outside world, and integrate nomadic devices into vehicle ergonomics, acoustics, and HMI.

Ubiquitous, seamless, and secure connected-vehicle operation at high driving speed will depend on an end-to-end architecture that integrates the onboard unit, roadside equipment, edge and core of the network, data center, and, eventually, the cloud.

For more information, please contact:

Andreas Mai
Director, Automotive Practice, North America
Cisco Internet Business Solutions Group
andmai@cisco.com
+1 248 455 1657

Dirk Schlesinger
Global Lead, Manufacturing Industries
Cisco Internet Business Solutions Group
dschlesi@cisco.com
+49 811 559 5488

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Endnotes

1. Other papers in the series include “A Business Case for Connecting Vehicles: Executive Summary,” Cisco IBSG, 2011; “Connected Vehicles and Government: A Catalyst To Unlock the Societal Benefits of Transportation,” Cisco IBSG, 2011; “Connected Vehicle Insurance: The Business of Preventing Crashes,” Cisco IBSG, 2011; “Connected Vehicles: Service Providers at a Crossroads,” Cisco IBSG, 2011.
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8. “‘Talking’ Cars May Someday Warn of Crashes and Save Lives,” *The Washington Post*, January 27, 2011; Cisco IBSG analysis of internal and external cost of personal transportation, 2011.
9. Connected vehicles extend Google’s Internet business model to the road. The combination of Google’s search engine (with Google Maps and navigation) and connected-vehicle capabilities provides an excellent platform for offering location-based services and context-relevant advertising to drivers / passengers.
10. For example, Google could charge local businesses for advertising through Google to vehicle occupants.

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