TELEMATICS LEARNING SERIES

The Case for the Enterprise Connected Car:

Driving M2M Mobility With Embedded Aftermarket Telematics Devices

By: Michael Harris

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Until recently, most people with a mobile phone had never heard of a social network or application store. Yet, these technologies forever changed the way people communicate and access information. Likewise, while M2M, connected car, and telematics are not yet everyday terms, these mobile technologies are revolutionizing the way vehicles are operated and managed by commercial and government enterprises.

Overview

A human being carrying a smart phone is a connected person. An automobile with embedded machine-to-machine (M2M) wireless communications and automotive telematics is a "connected car."

M2M simply means a machine, in this case a car, is able to communicate directly with other machines through a mobile network. Automotive telematics is a solution to access the wealth of information available from a vehicle's on-board digital sensors and Global Positioning System (GPS) location data. Commercial market applications are increasingly leveraging this information to do everything from enhancing driver safety, tracking driver behavior, and complying with government regulations – to supporting fleet management, providing emergency services, and in-vehicle Wi-Fi connectivity. The goal is to increase productivity and efficiency while reducing vehicle operating costs.

For corporate fleets, automotive telematics helps reduce accident rates by preventing distracted driving. Operating expenses are lowered by raising fuel economy and automating vehicle maintenance. Enhanced navigation tools optimize scheduling and routing to boost driver efficiency. Vehicle tracking capabilities improve asset and workforce management.

For the insurance industry, connected-car solutions offer opportunities to better manage risk and create new products and markets. For example, access to real-time vehicle and driver data may enable usage-based insurance and more accurate driver scoring metrics. Increased visibility into the behavior of high-risk customer segments, such as teen and senior drivers, allows insurers to better match premiums to customers. For lower-risk drivers and fleets, insurers with telematics intelligence may pursue more aggressive pricing to win market share. Adding extra services for policy holders (e.g., roadside assistance, accident alerts, and vehicle tracking) can help create greater customer loyalty and ultimately higher retention rates.

Businesses are eager to realize these benefits. However, sorting through the array of available automotive telematics device solutions can seem daunting. We'll map the terrain for easy navigation, starting with a quick overview of the enabling technologies.

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Technologies

The key technologies driving the connected car include automotive telematics and on-board diagnostics, plus GPS and M2M mobile communications.

GPS is a well-known solution for gathering precise geographic location information, whether through a cell phone, navigation unit, or a vehicle telematics device. Not only can GPS identify where a vehicle is, but also movement and speed may be calculated based on changes in the vehicle's position.

On-board diagnostics (OBD) offer access to a vehicle's engine control unit (ECU), the computer system that gathers data from digital sensors monitoring the auto's health and operation. With government encouragement, a series of industry standards were developed called OBDII. Today, 99 percent of all light-duty vehicles sold in the U.S. have an OBDII connector located within two feet of the steering wheel. Typically it is found under a car's dashboard, as illustrated in **Figure 1.**

Initially focused on vehicle emissions, a host of other information may also be accessed through the OBDII port, using standard Parameter IDs (PIDs). These PIDs cover everything from vehicle speed, engine RPM, fuel pressure, and battery voltage, to excessive idling or activation of the anti-lock braking system. In addition to OBDII, heavy-duty commercial vehicles now employ sophisticated sensor systems with a JBUS data interface.

Telematics information gleaned from GPS and the OBDII interface (as well as JBUS for a commercial vehicle) is transmitted to a remote telematics server over a GSM or CDMA cellular network through an M2M mobile interface. Applications can access the server data to track a vehicle's location, health, and performance. Additionally, smart phone applications can integrate mobile devices with the connected car to enhance automotive features and driver safety.

Figure 1: An on-board diagnostic device plugs into an OBD connector located within two feet of the steering wheel, under the dashboard.

Smart phone applications can integrate mobile devices with the connected car to enhance automotive features and driver safety.

Applications

While consumer and commercial applications share many similarities and goals, we can identify concentrated areas of interest. Emerging consumer connected-car applications include enhanced navigation, hands-free calling and texting, roadside assistance, vehicle theft tracking, and on-demand entertainment services. Additionally, businesses are interested in solutions that increase safety, productivity, boost their bottom-line, and deliver a solid return on investment.

All of these applications may be categorized as vehicle-centric, driver-centric, or integrated. **Table 1** describes each category and the most suitable application.

Devices

Generally, there are two broad categories of in-vehicle, connected-car devices: those bundled by a vehicle manufacturer at the time of purchase (OEM solutions), as illustrated in **Figure 2,** or those provided by independent suppliers for installation by the vehicle's owner (aftermarket solutions). OEMs offer both embedded and hybrid solutions. Aftermarket players offer these too, along with dedicated and portable product offerings. Embedded products **(Figure 3)** integrate wireless communications capabilities, while hybrid products connect through a driver or passenger's mobile phone via Bluetooth networking **(Figure 4).**

Figure 2: OEM Device

Figure 3: Embedded Device

Table 1: Connected-Car Applications & Device Suitability

CATEGORY	DESCRIPTION	DEVICE IMPLICATIONS
Vehicle-centric	› Fleet management › Vehicle diagnostics and maintenance › Fuel efficiency maximization › Vehicle emissions reduction › Vehicle tracking and geofencing › Vehicle theft detection and recovery › Vehicle asset tracking and management › Regulatory and document compliance	Always on embedded connected-car device required to capture OBD event driven data collection, alerts, and user requests for vehicle-centric applications
Driver-centric	› Distracted-driving scoring and mitigation › Navigation, traffic, and route optimization › Hands-free calling and text messaging	Driver-centric applications may be delivered via smart phone, hybrid or embedded devices. Requires embedding for multiple, simultaneous application support
Integrated	› Insurance scoring, risk monitoring and management, and usage-based insurance › Roadside assistance › Wi-Fi or hot spot-enabled vehicle › Infotainment	Always on embedded connected-car device; captures all data for historical reporting required to ensure optimal operation of vehicle-centric applications

Hybrid solutions could prove problematic for business users that need to run several applications simultaneously as many smart phones on the market today are unable to support a concurrent mobile voice call and data session. Even for those phones that can handle voice and data at the same time, bandwidth available through the phone is likely to prove insufficient for multiple applications. Therefore, an embedded telematics device with a separate mobile data connection for the vehicle is critical. With a dedicated M2M vehicle data connection, business users may use their mobile phones to access navigation, streaming media, hands-free calling, and email simultaneously, while the vehicle connects to multiple applications.

Furthermore, such an embedded device with mobile connectivity could be configured to operate as a Wi-Fi hot spot, providing high-speed data access for all passengers and devices in the vehicle, including laptop and tablet computers. Table 2 summarizes the categories of connected-car devices.

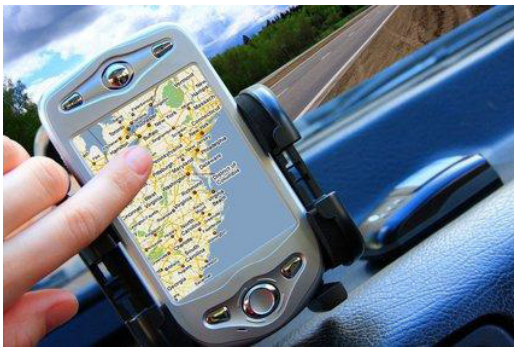

Figure 4: Hybrid Device

Even for those phones that can handle voice and data at the same time, bandwidth available through the phone is likely to prove insufficient for multiple applications.

Table 2: Connected-Car Device Categories

DEVICE TYPE	DESCRIPTION
OEM	
Embedded	› Factory-installed systems offered with new vehicles, either as standard or optional equipment (e.g., navigation, GM OnStar), with integrated mobile/satellite connectivity and voice-activated commands › Usually monthly or annual service subscription fees
Hybrid	› Factory-installed system that relies on driver or passenger mobile phone for wireless connectivity (e.g., Ford Sync) › Often sold as an upgrade option in new vehicles without a subscription fee
AFTERMARKET	
Embedded	› Dedicated telematics transponders integrate OBD, GPS, mobile connectivity and, in some cases accelerometers; self installed into vehicle OBDII port (e.g., A+ Tracker); integrated with robust applications
Hybrid	› In-dash installed products that integrate driver or passenger smart phones (e.g., Magellan RoadMate)
Dedicated	› Vehicle-installed products with a dedicated function, such as vehicle theft recovery (e.g., LoJack) or navigation (e.g., Garmin)
Portable	› Devices not installed in the vehicle but offering some telematics functionality (e.g., GPS navigation devices and smart phone applications)

Considerations

Several factors drive device-purchasing decisions:

Applications: The first step for businesses evaluating embedded connected-car devices is to prioritize the applications they require, as certain applications require specific device implementations. For example, if a business is most interested in vehicle-centric applications like remote vehicle diagnostics, vehicle asset tracking, as well as theft detection and recovery, an embedded device solution is required. With embedded products, the vehicle is always network-connected; whereas, a driver with a cell phone is required to gain access to vehicle data with hybrid products.

Costs and ROI: In today's economy, businesses do not have capital or operational expenses to spare. Any purchase must pay for itself in productivity gains and cost savings to meet a company's return-on-investment (ROI) criteria. Look for efficient product design, self-installation, and over-the-air updates to reduce telematics solution costs to further improve ROI. Monthly recurring expenses per vehicle can vary from $1 to $50 or even higher when device and application costs are considered. In some cases, enterprises have built their own applications that are customized to support insurance and fleet management applications.

Installation and activation complexity: While factory-installed OEM products may simplify installation issues, businesses are required to link automotive telematics with vehicle purchasing decisions. Ultimately, this may increase vehicle costs for a business by locking them into a particular vehicle manufacturer, rather than negotiating among multiple competitive suppliers. Choosing an aftermarket solution with simplified installation and a small form factor allows every vehicle in a commercial fleet to be covered with a common solution. Aftermarket solutions that require professional installation generate higher expense and longer vehicle out-of-service time.

Vehicle Compatibility: Whether OEM or aftermarket, the connected-car device must be compatible and able to communicate with the vehicle it monitors. For example, while nearly every vehicle includes an OBDII interface, the way each vehicle presents data through the interface can vary. Therefore, a vendor claiming compatibility with vehicles by simply offering an OBDII interface may come up short in practice. Choose an automotive telematics device provider with extensive real-world experience with the full spectrum of vehicles on the road.

Reliability and manageability: A device responsible for protecting people and vehicle asset value must be dependable and durable. Additionally, the device must be easy to manage with automated tools that enable the solution to scale to a large number of vehicles within a corporate fleet or insurance policyholder network. For example, products like the A+ Tracker from Applus enable alerts and vehicle health checks through a web portal.

Vehicle data collection capabilities: Retrieving on-board diagnostic data from a vehicle is both a science and an art. OEMs are experts at accessing data from their own vehicles, but not those of other manufacturers. Aftermarket players may be sophisticated electronics suppliers, but lack deep automotive OBD expertise. Seek solutions with the ability to collect OBDII data from a wide range of Parameter IDs (PIDs), ensure their wireless transmission, as well as remote aggregation and storage. Bear in mind that buying decisions today that are driven by a single application may be eclipsed by an expanding range of emerging applications in the next few years. Devices like the A+ Tracker can support over 70 different PIDs honed over many years of field testing, and have proprietary algorithms that enable calculated measurements that go beyond the OBDII standard.

Reporting and analytics: Telematics data collected from in-vehicle devices should be accessible on open-standard server platforms, with real-time reporting or analytics, accessible by web and business software. For applications like fleet management, regulatory compliance, and insurance, integration with complex enterprise and government IT systems is critical. Real-time correlation with logistics information, CRM databases, and other complex programs must be supported. Look for a device solution providing flexibility and extra reporting functionality that complements the application.

A device responsible for protecting people and vehicle asset value must be dependable and durable.

Cellular technologies: Embedded connected-car devices should support both GSM and CDMA cellular protocols with 3G data capabilities, enabling compatibility with all major wireless carriers. Broadband wireless speed will be increasingly important as automotive telematics devices are asked to carry more applications. Additionally, flexible data transmission intervals and packet compression techniques ensure efficient wireless network resource usage.

Application flexibility, integration, and interoperability: It is important that device data be available from the automotive telematics server in standard formats, allowing easy application integration and support for application layering and the simultaneous use of multiple applications.

Vendor service support: The best solutions are ones that are reliable, simple to use and require minimal vendor support. However, when occasions arise where extra support is required, favor suppliers with enterprise support expertise, product warranties, and integration experience.

Scalability: M2M Telematics devices are rapidly enabling the "connected-car" platform to support a multitude of applications that cut across business and consumer needs. Make sure you select a solution that can grow with your business as additional applications are added, bandwidth demands increase, and integration with other devices in your vehicle via Bluetooth or Wi-Fi hot spots are enabled.

Financial strength of supplier: Start-up or smaller players may offer innovative products, but be sure they have the staying power required to support the product and its evolution.

Automotive experience: While many suppliers have an impressive electronics pedigree, research their automotive expertise, particularly in the area of on-board diagnostics.

Broadband wireless speed will be increasingly important as automotive telematics devices are asked to carry more applications.

Conclusions

While there is a wide array of connected-car devices available, commercial and government customers are likely to find that aftermarket embedded telematics products best meet their needs for high-value, vehicle-centric applications. With an aftermarket solution, a business can cover its entire vehicle fleet with a common platform. This avoids the IT challenge associated with integrating different OEM platforms for each vehicle manufacturer.

An ideal aftermarket-embedded device will be designed to minimize product costs and support a simple plug-and play process, rather than an expensive and time-consuming professional installation. The in-vehicle device should be paired with an open, flexible, and scalable server solution to collect, store, analyze, and report automotive telematics data.

A vendor with real-world automotive experience, particularly vehicle OBD, is essential. The vendor should also be a supplier with enterprise support expertise and financial staying power.

With the automotive telematics terrain better mapped, you are now ready to roll.

About the Author

Michael Harris is principal consultant at Phoenix, Arizona-based Kinetic Strategies, Inc. Applying more than 15 years of experience as a strategist, research analyst, journalist, public speaker and entrepreneur, Michael consults with select clients in the networking, Internet and telecommunications industries.

About Applus Technologies

Applus Technologies, Inc. is part of the Applus Group, a recognized global leader in OBD technology and vehicle emissions and maintenance inspections, performing over 17 million vehicle tests annually in 40 countries on five continents, with annual revenues exceeding $1 billion. Applus Technologies also provides custom-engineered solutions for remote data collection, systems integration, and mobile asset management for government and enterprise customers. The financial strength of the Applus Group is backed by a majority shareholder, The Carlyle Group, a private global investment firm with over $106 billion under management.

Applus Technologies, Inc.

444 North Michigan Avenue

Suite 1110

Chicago, IL 60611

Phone: +1-847-616-6122

Email: solutions@applustech.com

www.applustech.com