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Designing Next-Generation Telematics Solutions

**White Paper
In-Vehicle Telematics**

Executive Summary

In-vehicle telematics has evolved over time with initial systems providing basic functions such as vehicle health reporting and location tracking. With the availability of higher-performance and more cost-effective computer and wireless (3G/4G, GPS) technologies, telematics is enabling a wider range of capabilities including navigation, driver behavior tracking, E-Call, and fuel-efficiency guidance.

For the past few years, the market has been dominated by OEMs offering in-vehicle solutions and by after-market telematics solution providers. Now, new players, such as telecom and Internet service providers, are entering the market, vying for customers who increasingly see telematics-based features as essential.

This paper discusses feature and technology trends in the telematics market and how the Intel Telematics Reference Design proof of concept (PoC) can help solution developers design innovative systems faster and with less effort.

> "Consumers are ready for advanced telematics features."
>
> – Intel Study,

Growing Telematics Market

According to ABI Research*, from 2014 onward, total global commercial telematics usage will ramp up at an accelerated rate. In fact, in 2019 total global subscriptions will increase by 3x from what they were in 2014.[1] Visiongain*, a leading business information provider, has assessed that the value of the global Connected Car market will reach $30.2 billion in 2015. From 2015 to 2019, the research firm forecasts nearly a sevenfold increase in the number of new cars equipped with factory-installed mobile connectivity designed to satisfy government regulations and consumer demand for safety and security features, as well as infotainment and navigation services.[2]

Key Factors Impacting Telematics

The following factors are expected to have a major impact on the design and adoption of in-vehicle telematics solutions.

- **Fuel Price**

    High fuel prices and increased fuel consumption due to traffic congestion raise the value of navigation systems that compute optimized routes.

- **Environmental Impact**

    Social awareness of the effect carbon monoxide emissions have on the environment increases the appeal for telematics features that reduce fuel consumption and monitor vehicle health.

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- **Crime Prevention**

  More instances of vehicle-related crimes, like carjacking, make vehicle tracking, E-Call services, and other safety-related telematics features more desirable.

- **Smart Phones and Tablets**

  Technologically-advanced mobile devices present an opportunity for automakers to substitute the computer running in-vehicle infotainment systems with the driver's smartphone or tablet, thereby reducing system cost.

Today, most of the consumer vehicle telematics systems already address some of these factors with features such as car insurance telematics, eco driving assist, fuel-theft monitoring, anti-theft, geofencing for safety, and remote diagnostics. This is achieved by connecting to the vehicle's on-board computer and gathering data, such as mileage, speed, braking style, and fuel level, to monitor fuel consumption rate and driver behavior. The global positioning system (GPS) provides the vehicle tracking data that can be superimposed onto realistic maps and views.

Technologies

The following describe several technologies shaping future telematics solutions.

Smart Phones and Tablets

Mobile devices are incredibly popular, and according to eMarketer.com*, by the end of 2015 one out of four people in the world will have a smart phone. This equates to 1.75 billion people who are potential telematics consumers,[3] especially as telematics solutions are increasingly integrated with smart phones and tablets. With location tracking, geofencing, and fuel-saving data available on handheld devices, drivers can make real-time decisions

from wherever they are. Service providers can also apply this data in ways that reduce the risk of speed-related accidents, control maintenance costs, and decrease fuel bills, all on the go.

Vehicle Data Monitoring

On-board diagnostics version 2 (OBDII) support vehicle self-diagnostic and reporting capabilities that collect real-time vehicle parameters for monitoring and performance analysis (e.g., fuel consumption rate). OBDII systems utilize in-vehicle buses, such as Controller Area Network (CAN), to allow in-vehicle microcontrollers and devices to communicate with each other without a host computer. OBDII has moved beyond the realm of professionals and hobbyists to telematics device manufacturers supporting fleet tracking, fuel efficiency monitoring, remote diagnostics, and pay-as-you-drive insurance. Although not originally intended for the above purposes, commonly supported OBDII data, such as vehicle speed, RPM, and fuel level, allow GPS-based fleet tracking devices to monitor vehicle idling times, excessive speeds, and fuel theft. OBDII data is also used to block mobile phone usage while vehicles are in drive and to record trip data for insurance purposes.[4]

Insurance Telematics

Assessing driver risk is a growing telematics service. Telematics technology operates via a small black box, which is installed in vehicles and measures driving behaviors, such as time and distance travelled, types of roads used, levels of acceleration and braking, and accident incidences. With this information, insurers can generate risk profiles based on driving behavior and charge a premium accordingly. The real benefit of insurance telematics lies in the opportunity for insurers to create

awareness of better driver behavior, and in turn, reduce the loss ratios of accidents. A very large percentage of insurance claims pertain to accidents, and speeding is a key cause.

Telematics is also used to implement usage-based insurance (UBI), also known as pay-as-you-drive, whereby the insurance rates are dependent upon type of vehicle used, measured against time, distance, behavior, and place. This paves the way for personalized insurance premiums based on individual risk profiles, rather than on aggregated market statistics. Moreover, drivers can now be rewarded with reduced premiums for good driving behavior, as well as penalized for poor driving practices.[5]

Platform for Next-Generation Telematics

Designed to help systems integrators incorporate key technologies into vehicles, the Intel Telematics Reference Design proof of concept (PoC) is a software solution that demonstrates various transportation services for both business-to-consumer and business-to-business use cases primarily for the passenger car segment. The PoC software runs on an Intel® Atom™ processor-based platform that sits in a telematics in-vehicle black box. The Intel Atom processor has the computing headroom needed to execute real-time data analytics, upload the computed data to the cloud, and send instantaneous driver alerts. In addition, the PoC supports real-time vehicle tracking, E-Call, fuel monitoring, remote diagnostics, eco driving, geofencing, and insurance telematics, which are shown in Figure 1 and described in the following section.

Main Features – Intel Telematics Reference Design PoC

Intel Telematics Reference Design PoC software contains mobile and web applications that generate real-time data that can be sent to the cloud, allowing telematics service providers to monitor vehicles from anywhere. The Intel PoC supports a wide range of applications, including:

Vehicle tracking can be used in a number of ways, such as anti-theft and enhanced vehicle security.

E-Call will automatically place a call for help in cases such as a medical emergency or accident.

Fuel monitoring allows drivers to determine if fuel may have been stolen or when they can reduce their fuel consumption by driving at slower speeds.

Remote diagnostics help avoid vehicle breakdowns by detecting when a vehicle requires service and alerts drivers accordingly.

Eco driving offers advice on how to reduce fuel cost through safer driving habits.

Geo-fencing is a technology that can detect when a vehicle crosses a virtual boundary around a real-world geographical area, triggering a message to be sent to the infotainment system or driver's cellular device.[6] This email or text message could be a coupon for a nearby store or a warning that the vehicle entered a more dangerous neighborhood, as well as many other possibilities.

Insurance telematics, which was previously discussed, enables driver behavior-based insurance fees, such as charging drivers less when they typically travel short distances at slower speeds than if they normally go long distances at higher speeds.[7]
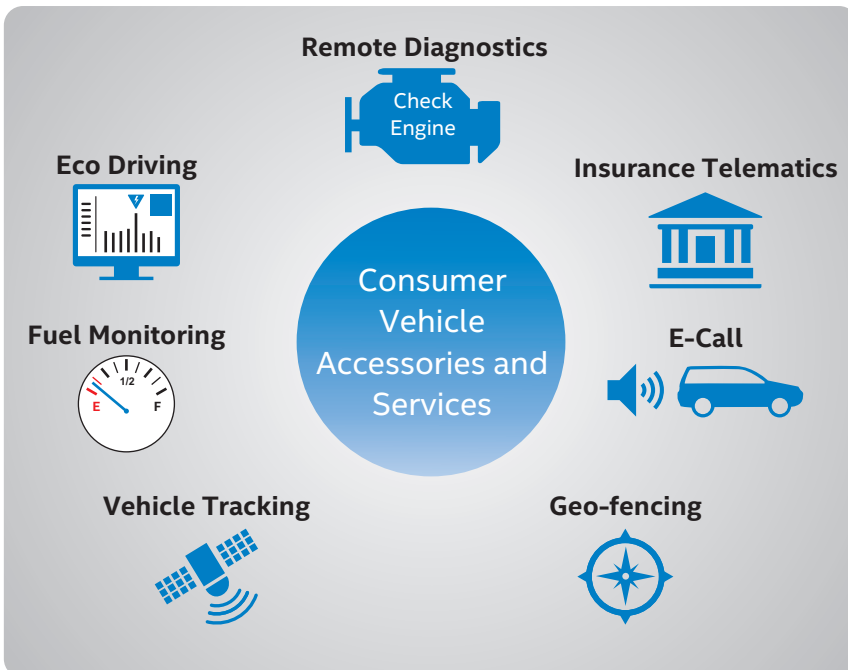

Figure 1. Example Applications Supported by the Intel Telematics Reference Design
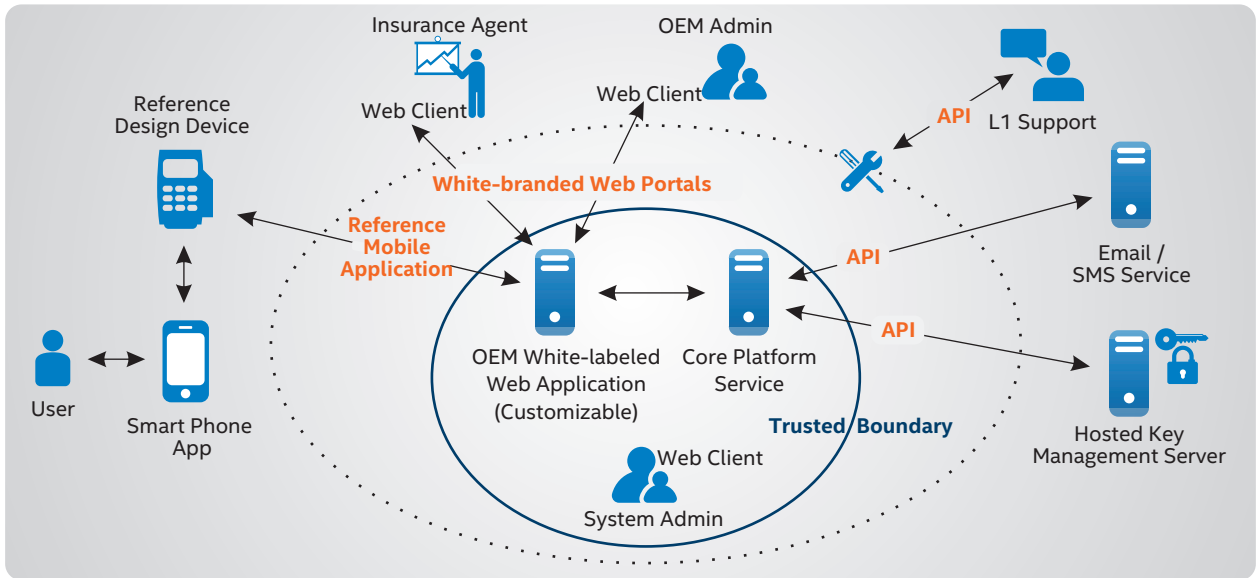
Figure 2. Intel Telematics Reference Design Architecture

Telematics Reference Design for OEMs

For OEMs providing vehicle maintenance services, this web portal provides detailed reports on vehicle health, car model, and owner history.

Telematics Reference Design for Insurance Companies

Insurance companies can access this web portal to view driver ranking and static reports, and notify drivers of rewards they earned for good driving.

Reference Architecture

Figure 2 illustrates the Intel Telematics Reference Design PoC architecture, consisting of APIs for Intel-hosted backend cloud services, reference mobile applications, and white-branded web portals serving end consumers and service partners such as OEM personnel and insurance agents. For example, portals could allow OEM personnel to view detailed vehicle reports, and insurance agents to access customer driving behavior reports when analyzing premiums.
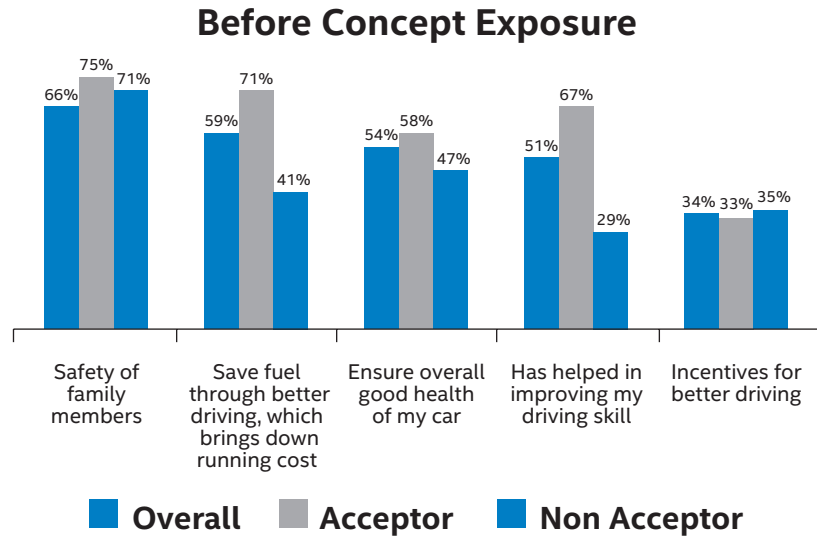
Case Study

Intel conducted a pilot test with 54 end users in India to measure the effectiveness of the Intel Telematics Reference Design PoC. The PoC software ran on a Eurotech* hardware platform based on an Intel® Quark™ SoC X1000. The results in Figure 3 indicate trip report, eco driving, geo-fencing, social score, and fuel monitoring (i.e., fuel theft) were the top-rated features among participants. Of the offered services, family member safety implemented with geo-fencing was considered the most important benefit of the offered services.
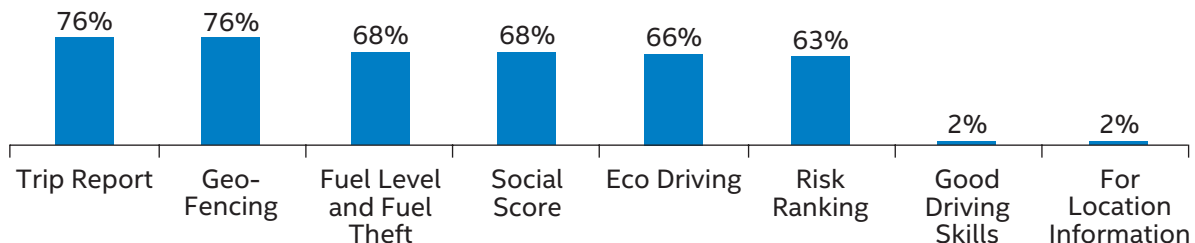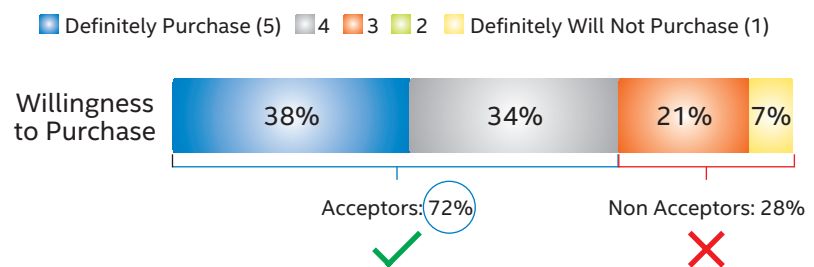

Overall

Figure 3. Overall Ratings for the Intel Telematics Reference Design PoC Features

Prior to the test, all test participants were asked which product benefit was most important, and family member safety scored the highest, as shown in Figure 4. Although participants had privacy concerns over vehicle location tracking, it seems the safety and security benefits generally outweighed this unease. Of those who found the product acceptable, fuel savings and improved driving skills followed in importance.

Before Concept Exposure

	Safety of family members	Save fuel through better driving, which brings down running cost	Ensure overall good health of my car	Has helped in improving my driving skill	Incentives for better driving
Overall	66%	59%	54%	51%	34%
Acceptor	75%	71%	58%	67%	33%
Non Acceptor	71%	41%	47%	29%	35%

Figure 4. Before Concept Exposure Rating for Benefits of the Intel Telematics Reference Design PoC

Figure 5 shows that 72 percent of the test participants said they were ready to purchase the product if there were incentives, like reward points, for good driving behavior. Summarily, test participants were satisfied with the features of the Intel Telematics Reference Design PoC, which was shown to have high go-to-market value.

Definitely Purchase (5)   4   3   2   Definitely Will Not Purchase (1)

Willingness to Purchase	38%	34%	21%	7%

Acceptors: 72%   Non Acceptors: 28%

Figure 5. End-User Acceptance Results

Future Plans and Conclusion

In the future, telematics solutions are expected to be compulsory in vehicles. To meet this need, Intel will continue to enhance its telematics software solution to better serve and help accelerate the telematics market.

As a future plan, Intel is developing a Linux*-based telematics software development kit (SDK) that supports device management, on-board diagnostics (OBD), CAN services, and sensor services such as accelerometer, location services, messaging, cloud connector, telephony abstractions, and device manageability API's. With this comprehensive framework, developers will be able to add value and run their innovative proprietary telematics applications on top of the Intel SDK.

Intel is also working on a next-generation telematics platform solution based on Intel Atom processors with an integrated modem, wireless connectivity (2G/3G, BT/Wi-Fi), and global navigation satellite system (GNSS) functions. This telematics platform consisting of hardware and software components provides a turnkey solution that is expected to shorten time-to-market for telematics solution developers.

Read more about Intel solutions for the automotive industry, visit **www.intel. com/automotive**.

[1] Source: BusinessWire*, "Global Commercial Telematics Subscribers will Reach Nearly 25 Million in 2014, According to ABI Research," October 27, 2014, **http://www.businesswire.com/news/ home/20141027005894/en/Global-Commercial-Telematics-Subscribers-Reach-25-Million#.Vc1kG_mqrW8**.

[2] Source: Visiongain* report, "Connected Car Market 2015-2025," **https://www.visiongain.com/Report/1345/Connected-Car-Market-2015-2025**.

[3] Source: eMarketer* web site, "Smartphone Users Worldwide Will Total 1.75 Billion in 2014," January 16, 2014, **http://www.emarketer.com/Article/Smartphone-Users-Worldwide-Will-Total-175- Billion-2014/1010536**.

[4] Source: Wikipedia*, **http://en.wikipedia.org/wiki/On-board_diagnostics**.

[5] Source: Insurance Gateway*, **http://www.insurancegateway.co.za/**.

[6] Source: Wikipedia, **https://en.wikipedia.org/wiki/Geo-fence**.

[7] Source: National Association of Insurance Commissioners, "Usage-Based Insurance and Telematics , April, 24, 2105, **http://www.naic.org/cipr_topics/topic_usage_based_insurance.htm**.