White Paper

Automotive Telematics

1.0 EXECUTIVE SUMMARY

At its core, automotive telematics deals with services provided to vehicles over a telecommunications device.

Some of the key services presently available in the domain of automotive telematics include:

- Automatic Crash Notification
- Roadside Assistance Services
- Vehicle Tracking
- Remote Door Services
- Navigation Assistance
- Traffic Assistance
- Concierge Services
- Infotainment Services
- Fleet Management
- Diagnostics

The future of the Telematics would be affected by the increased availability of bandwidth and the penetration of the wireless network infrastructure.

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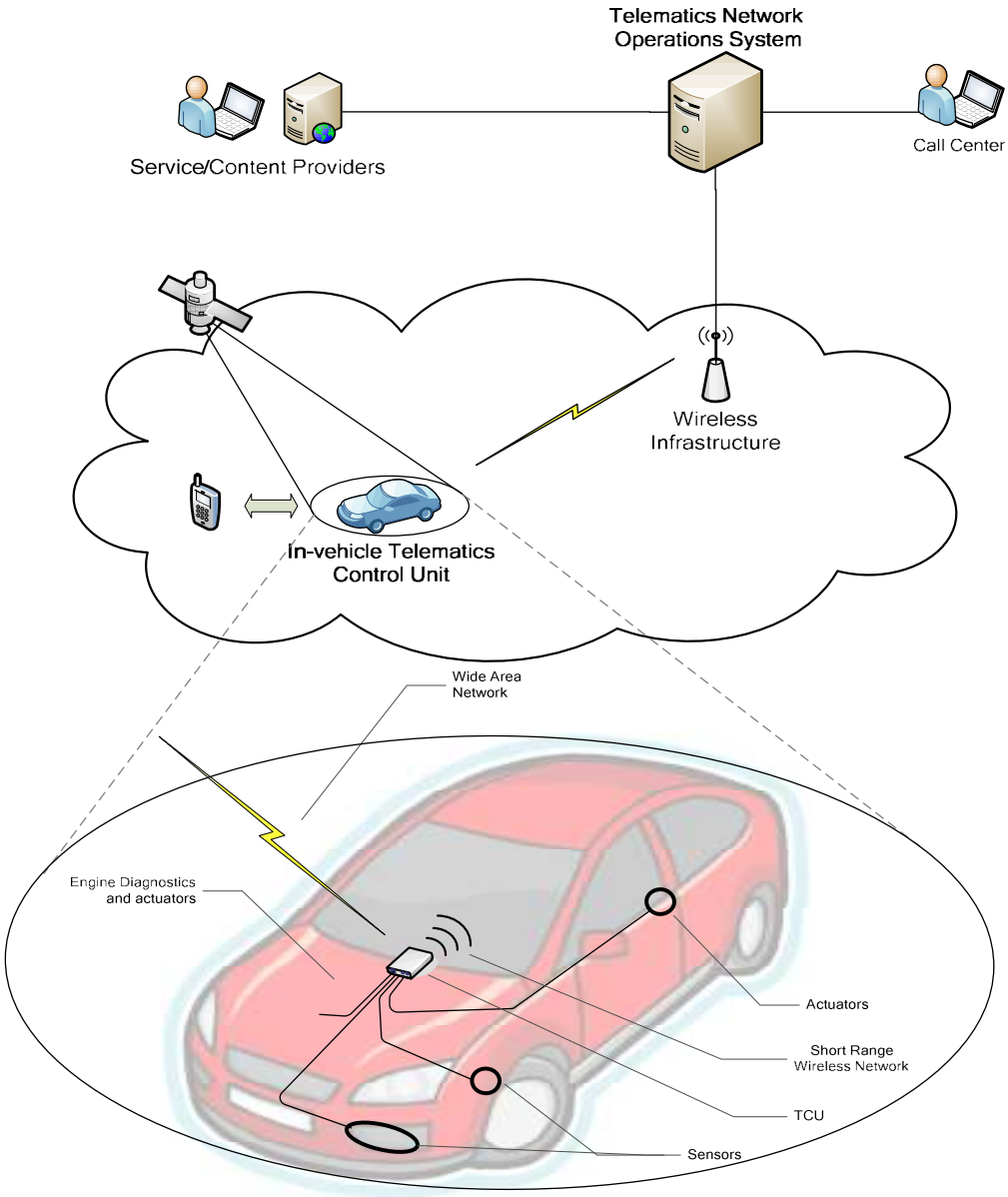
2.0 TELEMATICS SYSTEM ARCHITECTURE

The main components of a Telematics System are as follows:

- **Telematics Control Unit** – The TCU is the embedded in-vehcile control unit that communicates with the automobile ECUs and GPS satellite and accesses the telematics services over the wireless infrastructure.
- **Telematics Network Operations System** – The TNOS is the hub of the operations from where all the telematics services are delivered and all the raw data from the TCUs is processed. TNOS also performs the fault management, configuration, accounting, and security functions in the telematics system.
- **Wireless Communications Infrastructure** – The WCI provides the backbone for all the information exchange between the TNOS and TCUs and also between the TCUs in the form of adhoc networks.
- **Service Provider Call Center** – The SPCC houses the customer service representatives that communicate with the vehicle occupants to provide the emergency and non-emergency call services and access the customer and vehicle information from the TNOS.
- **Service/Content Provider** – The SCPs provide content such as Traffic feeds, music, video, on-demand streaming data etc to the TNOS for different telematics services.



3.0 TELEMATICS SERVICES

Most of the Telematics services can be categorized into the following:

1. Safety and Security
2. Information and Navigation
3. Entertainment
4. Diagnostics

3.1 Safety and Security Services

The safety and security services include the automatic crash notification, emergency and medical assistance. These were the first set of services to be provided as part of the telematics and also the primary motivation for the conceptualization of automotive telematics.

As part of the Automatic Crash Notification service the TCU monitors the various crash sensors of the vehicle and in the event of a crash it sends the details of the crash intensity and location information to the TOC and also initiates a voice call to the telematics call center from where a service operator can initiate the dispatch of emergency services. Request for emergency services can also be manually initiated by the vehicle occupants incase of an emergency or as a good samaritan for someone else in need of help. Also the TCU may have a alternate power supply which may allow it to operate in the event of the vehicle battery or electrical circuit failure due to a crash.

Security services provided by the telematics service providers include Stolen Vehicle Tracking and Anti-Theft Alarm Notification and remote door services. The in-vehicle TCU can be triggered remotely to send periodic precise location update messages to the Telematics Operations Center or it can be triggered automatically by the anti-theft sensors in the vehicle. Once activated, the Telematics Operations Center can track the vehicle and work with the law enforcement agencies for recovering and securing the vehicle and its occupants. As part od remote door services the TCU can be instructed to perform the door lock and unlock operations remotely from the TNOS.

3.2 Information and Navigation

The information and navigation services provide access from the vehicle to a variety of seamlessly integrated conveniences where the vehicle occupant can get access to location sensitive information and content. Examples of services in this category would be point of interest download, turn by turn navigation assistance and on call technical support. The TCU can also provide a personal area network to wifi/bluetooth capable devices inside the vehicle and provide them internet connectivity over the telematics wireless data network connection.

This category also includes the set of services provided to commercial vehicles and vehicle fleets. Geofencing, vehicle maintenance monitoring and fleet tracking are some of the services utilized for improving the productivity and efficiency of commercial vehicles.

3.3 Entertainment

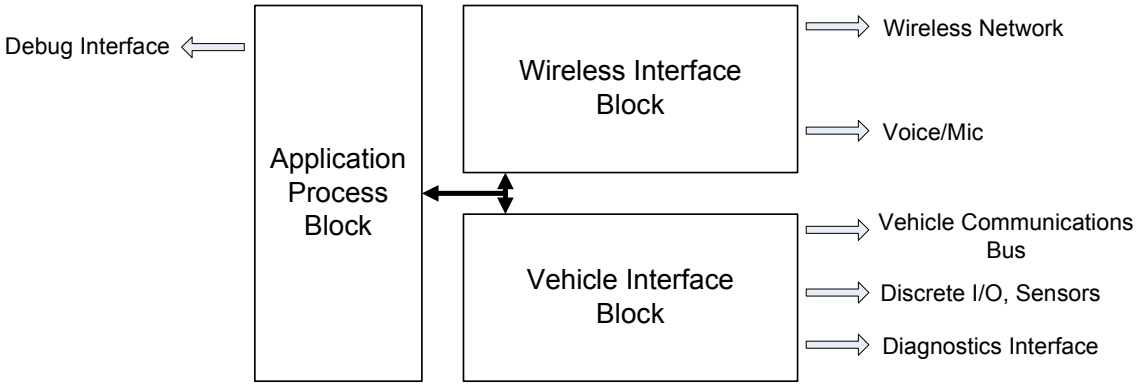
The entertainment services are an upcoming area of telematics that are getting a major boost due to the the increase in the bandwidth of emerging wireless technologies for exchanging data with the vehicles. On demand direct music/video downloading, internet radio, streaming content and synchronization with home entertainment library are some examples of the services in this category. Also improvements in the processing capabilities of the TCUs have lead to features such as interactive voice based command interface for accessing in-vehicle features by the vehicle occupants.

3.4 Diagnostics

Diagnostics is another upcoming area of telematics services. These include remote diagnostics, performance data collection, and remote DTC scanning service to name a few. The TCU in the vehicle is made capable of performing detailed diagnostic scans when triggered remotely or when certain key thresholds are crossed for e.g. distance travelled since last scan, time elapsed since last service etc.

4.0 TELEMATICS CONTROL UNIT

The main components of any in-vehicle telematics control unit can be represented based on funcationality as follows:



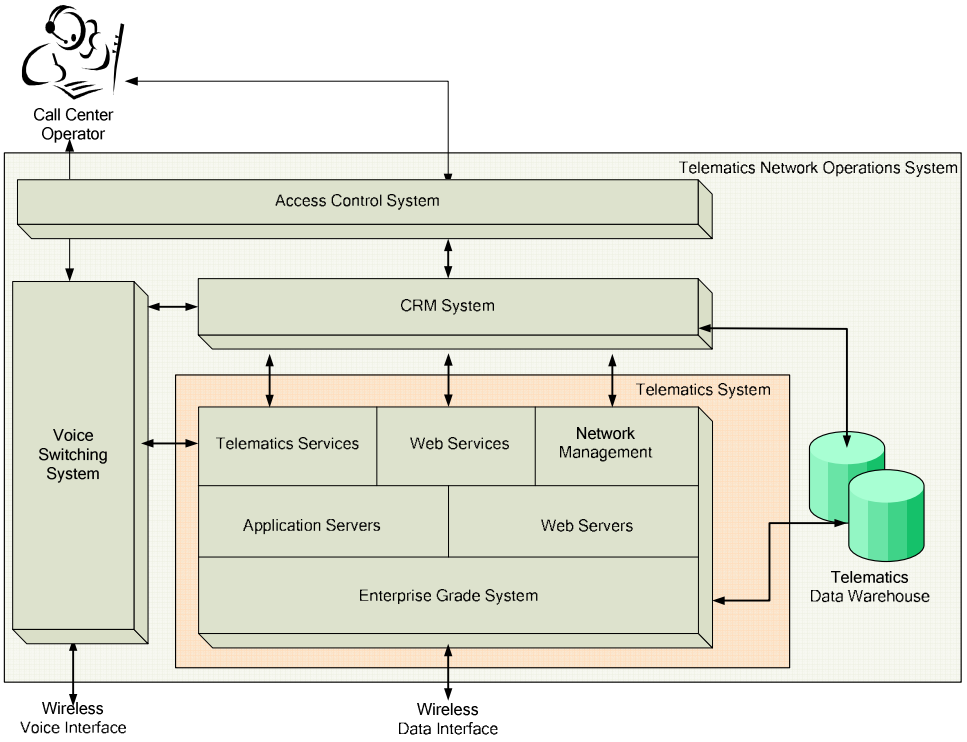
Application Process Block – The APB provides the platform for all the application level services provided by a TCU. The APB has an interface with the Wireless Interface Block and the Vehicle Interface Block. The APB interfaces with the other vehicle components through the VIB and interfaces with the Telematics network-side using the WIB. The APB is responsible for maintaining the state machines of all services and features and also controlling the other TCU blocks based on provisioning state and power modes amongst other factors. Features such as over the air provisioning and ECU software downloading allow the vehicle OEMs to keep all the ECUs in vehicle up to date with all the essential and critical software updates reducing vehicle recalls and maintenance cost significantly. The debugging functionality/Interface for engineering development is also a part of the APB functionality and aids in diagnosing and preventing potential system shortcomings. The APB should have the capability to detect and recover from any kind of software failures in any of the TCU modules. This can be enforced by strict health monitoring of all the TCU components, accurate diagnosis or the problem and the ability to take the corrective steps to recover from the problem. The APB should also manage the power states of the TCU to conserve the power usage in accordance with the ignition state of the vehicle and at the same time maintain connectivity with TNOS to send and receive messages.

Wireless Interface Block – The WIB provides the transport mechanism for communication between the TCU and the Telematics network. It encapsulates both voice and data communication. The WIB can provide access over one of the wide area network technologies including EDGE, EVDO and more recently Wimax and LTE. The WIB can also have more than one wide area access technologies for connecting with the Telematics network and utlize them based on network availability and available data rates. WiFi connectivity in the WIB can be utilized by the APB for providing connectivity to home networks for synchronization of data, music etc. Connectivity to smartphones and other cellular devices using short range access technologies such as Bluetooth, ZigBee and Wireless USB is also provided by the WIB. Both the APB and VIB can share interface for communicating and controlling the WIB. The information exchanged over the wireless data network may be secured by use of the standard security layers such as EAP between the TNOS and the TCU.

Vehicle Interface Block – The VIB is responsible for communicating with the rest of the vehicle ECUs. The vehicles communications bus, discrete I/O lines, sensors, actuators and vehicle diagnostics terminate at the VIB. There are several network types and protocols presently in use for in-vehicle network, the prevelant ones in use include LIN, MOST, CAN and Flexray. VIB also controls the GPS receiver that utilizes the Global Navigation Satellite System for calculating and provising the precise location and timing information to the TCU.

5.0 TELEMATICS NETWORK OPERATIONS SYSTEM

Below diagram shows the high level conceptual blocks of a Telematics Network Operations System:



A brief description of the main components is provided below; more details are ouside the scope of this whitepaper:

Access Control System – The ACS controls the access to the entire TNOS for the administrators, call center operators and also restricts the access privileges according to the assigned roles.

CRM System – The CRM system handles all the business requirements of organizing the acquisition, aggregation, and analysis of customer profiles, subscriptions and telematics service usage. It is also responsible for mediating the voice and data usage with the service providers and generating and managing the customer billing.

Voice Switching System – The voice switching system multiplexes the incoming voice calls from the TCUs and delivers them to the assigned call center operators. It may also synchronise with the telematics services module for delivery of the voice and data to the call center operator.

Telematics System – The telematics system encapsulates the telematics services described above, the web services for providing access to TCU service data to the call centers, the network management module for managing and monitoring the TNOS, the application servers hosting the telematics services and maintaining the states of all the telematics service instances persistently. The telematics system can be hosted on a enterprise grade system that can be scaled as the number of users grows and does not compromise on performance while providing high reliability and geographic redundancy.

PROPRIETARY NOTICE

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APPENDIX A ABOUT HUGHES SYSTIQUE CORPORATION

HUGHES Systique Corporation (HSC), part of the HUGHES group of companies, is a leading Consulting and Software company focused on Communications and Automotive Telematics. HSC is headquartered in Rockville, Maryland USA with its development centre in Gurgaon, India.

SERVICES OFFERED:

Technology Consulting & Architecture: Leverage extensive knowledge and experience of our domain experts to define product requirements, validate technology plans, and provide network level consulting services and deployment of several successful products from conceptualization to market delivery.

Development & Maintenance Services: We can help you design, develop and maintain software for diverse areas in the communication industry. We have a well-defined software development process, comprising of complete SDLC from requirement analysis to the deployment and post production support.

Testing : We have extensive experience in testing methodologies and processes and offer Performance testing (with bench marking metrics), Protocol testing, Conformance testing, Stress testing, White-box and black-box testing, Regression testing and Interoperability testing to our clients

System Integration : As system integrators of choice HSC works with global names to architect, integrate, deploy and manage their suite of OSS, BSS, VAS and IN in wireless (VoIP & IMS), wireline and hybrid networks.: NMS, Service Management & Provisioning .

DOMAIN EXPERTISE:

Terminals

- Terminal Platforms : iPhone, Android, Symbian, Windows CE/Mobile, BREW, PalmOS
- Middleware Experience & Applications : J2ME , IMS Client & OMA PoC,

Access

- Wired Access : PON & DSL, IP-DSLAM,
- Wireless Access : WLAN/WiMAX / LTE, UMTS, 2.5G, 2G ,Satellite Communication

Core Network

- IMS/3GPP , IPTV , SBC, Interworking , Switching solutions, VoIP

Applications

- Technologies : C, Java/J2ME, C++, Flash/lite, SIP, Presence, Location, AJAX/Mash
- Middleware: GlassFish, BEA, JBOSS, WebSphere, Tomcat, Apache etc.

Management & Back Office:

- Billing & OSS , Knowledge of COTS products , Mediation, CRM
- Network Management : NM Protocols, Java technologies,, Knowledge of COTS NM products, FCAPS, Security & Authentication

Platforms

- Embedded: Design, Development and Porting - RTOS, Device Drivers, Communications / Switching devices, Infrastructure components. Usage and Understanding of Debugging tools.
- FPGA & DSP : Design, System Prototyping. Re-engineering, System Verification, Testing

Automotive Telematics

- In Car unit (ECU) software design with CAN B & CAN C
- Telematics Network Design (CDMA, GSM, GPRS/UMTS)

BENEFITS:

- **Reduced Time to market** : Complement your existing skills, Experience in development-to-deployment in complex communication systems, with key resources available at all times
- **Stretch your R&D dollars :** Best Shore" strategy to outsourcing, World class processes, Insulate from resource fluctuations