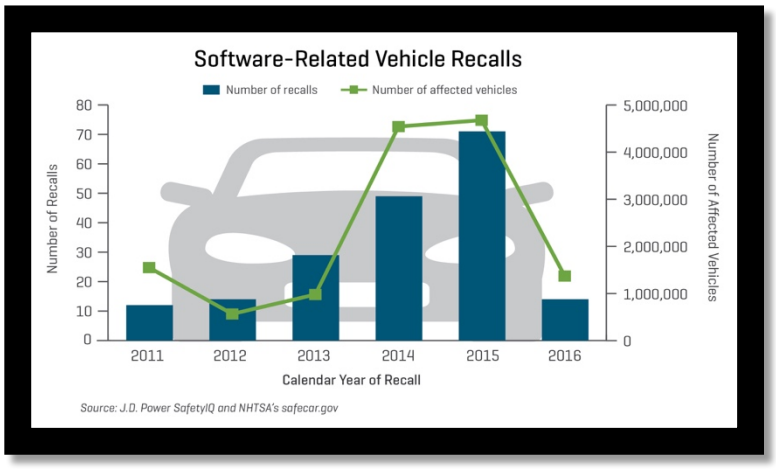
Connecting ALL Cars – Is the Cloud the Answer?

How do we enable full connectivity without breaking the bank?

Chuck Link, President and CTO, M2MD Technologies, Inc.

The automotive industry is experiencing sea-change as automakers face new transportation, mobility and ownership paradigms. The customer is increasingly focused on what is in the cabin and how to stay connected versus what is under the hood. This change is redirecting investments, strategies and the roles of the automaker's Executive Team as mechanical and electrical engineers are being forced to cede leadership to software engineers in the face of competition from Silicon Valley technology companies. The autonomous car, telematics and being connected to the vehicle and owner are becoming necessary core competencies for automakers. To accomplish this goal, automakers are attempting to develop deep expertise through partnerships and hiring experts. The stakes are huge, the options are diverse, and even minor missteps can become expensive multi-year setbacks.

The connected car has proven to be a strategic tool for automakers allowing for the collection of important customer information, big data and the ability to remotely update vehicle software. Software recalls are growing at staggering rates as the lines of code in a vehicle continue to grow. J.D. Power's analysis shows that 189 software-related recalls have been issued over the past five years affecting more than 13 million vehicles with 2015 recalls more than double those in 2013. As the autonomous vehicle becomes commonplace, connectivity and remote updates will become even more important, so automakers need to figure out how to cost-efficiently keep every vehicle active on the network.



More and more of the telematics value chain is being developed internally by the automaker as a means of gaining full control of the connectivity and customer experience as well as to lower costs. The need to improve agility and scalability while minimizing cost has many automakers looking to the cloud. Is the cloud the answer?

Now is the time for every automaker to evaluate their connected car strategy and related business models to determine whether cloud computing can transform their solution.

Challenges with Today's Telematics Platform

Planning for the future requires a brief review of the current solutions to better appreciate the magnitude of change and resulting benefits. Telematics was originally launched as a safety feature in 1996 with both Mercedes-Benz and Cadillac offering a few features with Automatic Crash Notification (ACN) as the core service. Over the next 15 years, the passive safety services such as ACN were complimented with more active remote control features, including POI downloads, navigation assistance, remote lock/unlock and eventually the introduction of the companion mobile app.

Given the nature of the emergency services provided and the automaker's brand reputation at stake, the architecture required to support the back office was daunting. The best data centers, servers and connectivity options were selected with full redundancy and back-up power. Although data centers were being built at a rapid pace, the unique power and cooling demands of the latest high-density servers left few and mostly expensive choices.

A typical telematics data center included the best firewalls, routers, switches and servers. Higher-end solutions used advanced load balancers and session border controllers to optimally manage the traffic. Software ran in a virtualized-environment supported by specialized controllers for the servers and storage arrays. Media gateways and specialized telecom channel cards were installed to interface to the wide variety of external network connections. DNS servers, AAA servers and SMS gateways were configured to support the various communications paths to the vehicles. To synchronize everything, redundant GPS clocks were installed in each data center. Automatic tape backup procedures were initiated with regular cycles and offsite storage.

All this infrastructure was for one data center and usually for one brand. The automotive industry requires redundancy and geographic diversification. Redundancy included wired data circuits using dual carriers. Each wireless operator had at least two connection points, so each telematics data center had to connect to each of the operator's connection points. Circuits between SMS and packet data were not shared requiring even more circuits. For every production environment, a comparable development, testing and staging environment was created to test and validate development software, minimizing the risk of failures when it moved to production.

"The telematics industry was on the bleeding edge of technology as the introduction of new services and wireless technology resulted in constant change and investment to the supporting back office," notes Tim Nixon, former CTO of OnStar.

Today's Telematics Business Case is Broken

The list of equipment, the maze of connections and the capital expenditures required to support most telematics programs today is not for the faint of heart. Dedicated environments, specialized equipment and the resources required to support the architecture is a major investment. To make the business case for telematics work, automakers burdened the customer for financial support in the form of subscriptions. Subscriptions generally include a "free" trial period followed by a paid subscription. A subscription-based model will never yield the desired 100%

connectivity needed for critical vehicle software updates and quality management programs, and the current models are far from achieving this ubiquity of connected cars.

The impact of investment placed a huge financial burden on the telematics industry limiting innovation and growth. Wireless operators and Telematics Service Providers (TSPs) attempted to gain economies by developing platforms to serve multiple automakers. Automakers outsourced many of the functions required to support telematics, but the economics still required customer subscriptions.

"The telematics industry was making huge leaps in vehicle connectivity but little attention was focused on creating a business model which would result in 100% connectivity," said Roger Lanctot, Associate Director at Strategy Analytics. "Today's telematics platforms are so customized for the automotive industry that very few innovations from the broader IoT have yielded any benefit to the telematics industry," Lanctot added.

The Automaker Do-it-Yourself Era

Recognizing the importance of their telematics programs and the need for 100% connectivity, automakers have begun to take greater control of the connected platforms. With various approaches being deployed, almost all of the solutions in the market today are based on custom telematics platforms, extensive data center arrangements, redundancy and costly circuits required to support the data and voice communications. Without an enormous connected customer base, the business case around these solutions will likely require customer subscriptions. As a pioneer in the IoT industry, automotive telematics is paying the price for being an early adopter.

As automakers invest in the next generation of telematics and build their own platforms, there is an opportunity to leverage the newest hardware and software solutions and cloud environments to provide the desired control, as well as address the business case required to get to full connectivity.

The difficulty, skills, time and cost involved in building the entire technology stack for smart, connected products is formidable and leads to specialization at each layer. Just as Intel has specialized in microprocessors and Oracle in databases, new firms that specialize in components of the smart, connected products technology stack are already emerging, and their technology investments are amortized over many thousands of customers. Early movers that choose in-house development can overestimate their ability to stay ahead and end up slowing down their development time line.[1]

The Promises of Cloud Computing

[1] "How Smart Connected Products Are Transforming Competition"; by Michael Porter and James Hepplemann, Harvard Business Review, November 2014.

Cloud computing in various formats has been around since the early 1980's yet has had limited impact in changing the telematics industry. Advocates claim that cloud computing allows companies to avoid upfront infrastructure costs and focus on projects that differentiate their businesses instead of on infrastructure. Proponents also claim that cloud computing allows enterprises to get their applications up and running faster, with improved manageability and less maintenance, and enables IT to more rapidly adjust resources to meet fluctuating and unpredictable business demand.[2]

In the early days, cloud computing was focused on providing basic data center server and storage functions consisting of countless racks of servers, all running hypervisors subdividing the physical servers into numerous virtual servers. A hypervisor is low-level computer software that runs on servers that allow multiple virtual computers to be created on a single physical computer. Each virtual computer is called a "virtual machine" (VM), and typically a virtual machine hosts an operating system such as Linux or Windows.

Today, cloud computing is far more than a computing and storage mechanism with solutions equally focused on applications to support most enterprise functions. The advancements in the virtual computing environment have created extremely flexible and reliable computing engines for all sorts of applications. A typical virtual environment is self-healing between and among numerous physical servers. This computing environment is designed to serve multiple unrelated and fully isolated independent applications although they may share physical hardware resources. It is possible to subscribe to one or as many virtual servers as are required for meeting functional requirements and scaling the business to meet the demand.

Another major contributor to the advancement of modern cloud computing is through network function virtualization (NFV) and software-defined networking (SDN). Just a few years ago, when additional firewalls, routers or load balancers were required, the procurement team began the task of researching, evaluating and negotiating. Special purpose-built hardware was the only way to meet the custom networking needs with the required performance. This hardware had to be installed in private data centers. This process resulted in expensive and slow deployments. Spare equipment and replacement parts had to be purchased and locally stocked to guarantee high availability service while driving the dedicated networking hardware costs higher.

Today, through SDN and NFV, the same functions with equal or better performance to the custom-built hardware can be deployed in the cloud and scaled with almost zero lead-time. NFV is a network architecture concept that uses the technologies of IT virtualization to virtualize entire classes of network node functions into building blocks that may connect, or chain together, to create communication services.[3] As the innovation cycles continue to accelerate, hardware-

[2] "What is Cloud Computing?" Amazon Web Services, 2013-03-19, retrieved June 20, 2016.
[3] "Network Functions Virtualization", European Telecommunications Standards Institute, www.etsi.org website, retrieved June 30, 2016.

based appliances rapidly reach end of life. Simply having a hard-wired network with boxes dedicated to single functions is not the optimal way to achieve dynamic service offerings. [4]

Cloud solution providers have invested in both the computing hardware to host and manage applications, but also in the functionality typically required to support a wide variety of needs. The largest of the service providers, Amazon Web Services (AWS) and Microsoft Azure, each provide nearly 100 services including mobile app development, enterprise applications, data management and robust analytics to name a few. These applications, integrated by design, can be tailored to support most, if not all, telematics features. These cloud based services can accelerate implementation timelines dramatically. The biggest benefit is economical – very little if any capital expenditure is required to start, incremental costs are low and scale as the business warrants.

Cloud computing has another major advantage related to the manpower to manage the architecture, networks and related equipment. Cloud solution providers have dedicated resources to manage and operate the solutions 24x7. Additionally, cloud providers are continuously investing in their platforms and upgrading equipment with advances in technology. Avoiding dedicated operations and R&D resources will have a positive impact on the business case.

The advantages of the advances in cloud computing with NFV, SDN and related technologies have resulted in massive shifts to virtualized networks and operations. Most major telecommunications operators have programs underway to transition their networks from the dedicated hardware model to a network defined by software running in virtualized servers. Operators are also actively connecting their network to the major cloud solutions to simplify integration, enhance performance and lower the cost of connectivity.

Some wireless operators offer direct connections to many different cloud providers, providing the enterprise network with a reliable connection while securing the connectivity from the online threats and attacks of the Internet. These connectivity options move the enterprise traffic off the Internet to highly secure private networks. Most operators offer connectivity to the top cloud-computing providers, including Amazon Web Services, Microsoft, Cisco, HP, IBM, VMware and Salesforce.com.

With AT&T NetBond®, customers will be able to access business applications and information that are stored in the cloud, bypassing the public Internet and the security risks associated with it. The benefits of using NetBond include the enterprise-grade network security of virtual private networking (VPN), providing predictable performance compared to the Internet and connections.

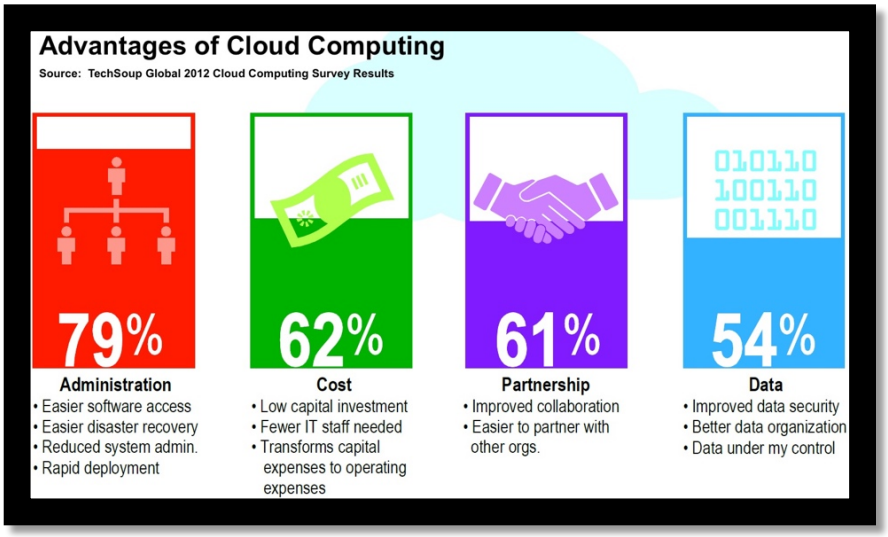
[4] "Network Functions Virtualization", European Telecommunications Standards Institute, www.etsi.org website, retrieved June 30, 2016.

"By embracing the latest cloud technology, automakers can significantly accelerate their telematics deployments, scale more efficiently and dramatically reduce their overall program costs," said Chris Penrose, senior vice president, Internet of Things, AT&T

By definition, if cloud computing can provide all the same functionality as found in today's connected car solutions, it can have a significant impact on the business model by limiting the upfront infrastructure costs and ongoing operations costs. Likewise, the costs can scale with volume. The determining factor is the availability and acceptability of the required functionality.

Is Cloud Computing the Answer?

With all the advantages of cloud computing and the challenges of today's architecture, automakers and related solution providers should seriously consider this option. Although these advantages are tremendous, cloud computing does have some elements that were built for Internet solutions as compared to the unique connectivity of cellular based solutions deployed in the telematics industry. The good news is that these elements are manageable and solutions exist to take full advantage of cloud computing with some enhancements.



Enhancements to the conventional cloud computing IoT platforms should be considered to address the unique industry of automotive telematics and cellular based connectivity. For example, the automobile has limited power capabilities while parked and communications must be carefully managed so the battery is not inadvertently drained. Additionally, the security requirements for the automotive industry are challenging and conventional security is not suitable. Each security session with an automobile must be fast and carry low data overhead. Over-the-air updates to security must be supported given the remote nature of the vehicle. Given that each communications session with a connected car has a cost, such sessions must be engineered to be quick and efficient. All such enhancements are manageable but are critical to the overall telematics strategy that wants to leverage the advantages of cloud computing.

Automotive telematics can significantly benefit from the advantages of cloud computing and strengthen the security and connectivity required with simple enhancements.

The Big Opportunity – Leveraging the Cloud to Drive the Next Generation Telematics Platform

Cloud computing can certainly have a major impact on the new era of telematics. Programs to date have struggled to make the business case work largely given the significant investments required. Cloud computing offers tremendous technical and resource advantages but the real benefit is economic.

However, like any IT program, careful consideration must be given to each service and feature of a telematics program to ensure the customer experience is safe, secure and reliable. As highlighted above, there are a few notable services that require additional consideration and likely customization to truly develop a world class telematics solution.

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About the Author

Mr. Link is the President and Chief Technology Officer for M2MD Technologies, Inc., a company focused on securely connecting machines to mobile devices. Previously, Mr. Link was Chief Technology Officer and a co-founder of Hughes Telematics, Inc. (now known as Verizon Telematics Inc.), where he served as the Chief Technology Officer from the company's inception through its acquisition by Verizon in 2012 until he departed in early 2015. Mr. Link was responsible for the technology foundation of the company and focused on vehicle connectivity, network architecture and strategy for the company's OEM telematics offerings. Most recently, Mr. Link led the successful technology rollout of services for Mercedes and Volkswagen in China.

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