Title:	**Emergence of Consumer Solutions in Vehicle Telematics**
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Introduction and Abstract

With the launch of several nationwide products and programs, consumer vehicle telematics has established relevance in the North American market. As the largest per capita automobile market in the world, this marketplace will be the proving ground for consumer telematics, and will set standards for business models, product features and corporate partnerships in consumer telematics the world over.

This paper seeks to describe qualitatively the emergence of consumer telematics from a perspective inside the industry, and draws from collective experience and anecdotes in the industry. The paper begins with a description of the current state-of-practice consumer offering and the value chain that supports it. Following is a description of key issues that influenced development of the offering over the period from 2000 to the present. Included finally is the confluence of events and changes that have led to a persistent consumer telematics presence in today's marketplace.

Section I: What Does the Current Consumer Offering and Ecosystem Look Like?

Consumer Features and Cost

Popular consumer telematics solutions have something for everyone: cool, real-time controls, stolen vehicle tracking and recovery, and reliable safety features. Following is a catalog of features of today's most successful offerings.

Stolen Vehicle Tracking and Recovery

Stolen vehicle tracking features are sometimes accessible to end-users, but mature offerings leave the tracking and recovery to professional call center teams who work in tandem with law enforcement. High-speed chases are not common (although they make good news stories)—the most effective stolen vehicle recovery mechanism is one that silently disables the vehicle starter and regularly reports the vehicle's position until it stops, at which time the police are dispatched to recover the vehicle. A car alarm linked to the telematics unit typically triggers the beginning of position reporting, although a Geo-Fence perimeter feature or a motion sensor on a stand-alone telematics unit may work as well.

Panic Button with Emergency Roadside Assistance and PSAP Dispatch

One of the highest value features, and the most difficult to deliver, is real-time emergency assist. OnStar and ATX with its TeleAid products set the standard here, with immediate voice response to any emergency situation. OnStar's response is typically quicker and more reassuring than that of a 911 operator, and greatly enhances the consumer's sense that their vehicle is a 'safe place'. For much less than half the price of OnStar, though, telematics solutions can provide a large part of this service. The cost savings comes from eliminating the voice connection to the operator. The best such service has the following user interface: The user presses the panic button in the vehicle, and a light under the dash

flashes orange to indicate that the distress call has been sent. Once the call has been received, the light goes to solid orange. When position of the vehicle has been determined and help is on its way, the light turns solid green.
The most difficult part of delivering automated panic button functionality is maintaining the reliability required for UL certification.

Lock / Unlock Doors
Part convenience, part safety feature, the ability to unlock doors through a call center or web or touchtone interface is also really cool to demonstrate. Along with remote start, it's one of the most popular features to wire into a telematics unit, and is safe to control at a distance. Although many users would pay a great deal for this feature when they don't have it, the industry hasn't figured out a really good way to charge differentially for the feature in 'panic' situations.

Track Position
The GPS coordinates transmitted from a telematics unit to server on request may be stored and retrieved for access at a later time. So, more than indicating present location, 'crumbtrails' and historical data on the vehicle may be selected and reported over time. The option to track continuously may be triggered remotely, so that position reports stream continuously to the person monitoring the vehicle. Speed, heading, device status or the status of inputs may be reported in addition to GPS coordinates.

Detect Excessive Speed
Excessive speed notifications have two applications for consumers: monitoring teen driving and detecting unsafe use of vehicles in a home business fleet. The most customizable of devices allow multiple thresholds to be triggered in the device, but the most basic form this feature takes is as a response to a request for 'fastest speed of the day'. The notification may be delayed until the end of a trip during which the speed threshold is exceeded. That way, there is at most one notification per trip; there is no need to acknowledge multiple notifications when speed is routinely exceeded. A side benefit is that the notification message is delivered at the best moment for taking action: when the driver is no longer likely to be distracted, and has just committed the infraction.

Perimeter Violation
Commonly known as 'Geo-Fence', the perimeter violation feature can be used in a variety of ways. It can be used with a relatively large region (such as a 5-mile radius circle centered at the vehicle owner's home) to detect when a new driver has driven the vehicle farther away than the local mall. With a small region (such as a 100-meter radius circle centered on the vehicle's current location), it can be used in place of a car alarm to detect vehicle theft, whether tow, hotwire or flatbed is used. It can also be used in tandem with a car alarm as a significant enhancement, as described below.

Alarm Integration
The wireless component of telematics devices gives car alarms a global notification reach. When integrated with the alarm, the telematics device can report door or ignition violations to the vehicle owner at any place and any time. With further integration, alarm manufactures have tied the perimeter violation to their own alarm features. In one popular implementation, triggering a door violation puts the GPS unit into a 'hyper' state, where the position of the vehicle is monitored closely to determine whether it is moving. As soon as GPS movement is detected, the perimeter violation is sent as a notification to an end-user or call center.

Cost
The offerings discussed in this paper all include wireless communications and GPS together, at minimum. While chipmakers have promised a radio+GPS chipset for $25 in volume, the solutions on the market today still use multiple components integrated together, where the raw parts cost exceeds $100. As a result, with typically three or four vendors in between the manufacturer and the consumer—and adding in service costs for installation and some limited period of communications service—the average price of devices ends up between $499 and $799. Additional features are financed in one of two ways: either by adding interfaces to the service (Web site, automated touchtone phone interface, or human response

center) or by connecting additional inputs and outputs to the device (such as remote starters, door locks/unlocks, or starter interrupts).

The service side has thus far based cost on the largest variable technical input into the service, which is wireless communications. A ‘per-communication’ or ‘per-use’ loaded rate of between $.50 and $5.00 (depending on amount or purchase) is passed on to consumers. This pays for call center operators, phone lines, database licenses, server hardware, colocation facility, software development and testing, voice interface cards, text-to-speech engines, credit card processing fees, billing, and overhead in addition to wireless communications costs.

Value Chain Analysis

The value chain for consumer telematics consolidated during the market collapse of 2000-2001. Combination of major players and the elimination of static caused by pretenders have contributed to the maturing value chain in 2003 and 2004. Players fall into three categories: hardware, service and brand (or distribution) partners.

Hardware Partners

High-level design takes place in whichever North American market the service is intended for. Basic device features and functions like inputs and outputs, meters, exceptions, contents of non-volatile memory, and power management are specified to meet business requirements. Low-level design, where hardware and firmware components are configured in prototype fashion to meet high-level design requirements, may take place domestically or offshore.

The manufacturers of the consumer telematics components are the same companies that make in-vehicle navigation and wireless handsets. With offshore production, hardware manufacturers and integrators achieve profit or suffer loss based on margin, which is improved through economies of scale. Several manufacturers have achieved production volumes of five figures, but costs will continue to drop until we break the six-figure and seven-figure barriers.

Service Partners

While the hardware ecosystem is mostly linear, the value chain on the services side is more like a web than a chain. Call centers, communications aggregators, roadside assistance centers, location-based service providers all work together to create a complete product based on the hardware.

User Interface

The most visible part of the service to consumers is the user interface. With OnStar-type solutions, the user interface is a button in a vehicle and a voice on the phone. However with the new class of true consumer applications, the most common interfaces are automated phone attendant, Web and SMS. The Web offers a rich feature set, including customizable notifications, vehicle control panels, status displays, and tracking maps. In addition, the most successful offerings support prepaid usage by accepting credit card payments in return for prepaid use plans, and displaying complete logs of past account activity and purchases.

While the Web interfaces are information-rich and highly customizable, no notification system is complete without an automated voice interface. This is because any real-time notification system must employ the most common real-time notification mechanism: a phone call. The best voice interfaces are lightweight and easy to use: in addition to notification they also provide the most essential ‘outbound’ features such as vehicle location, vehicle control, and turning notifications on and off.
While not visible to consumers, installer interfaces and technical and billing support interfaces must also be provided side-by-side with the user interfaces.
Critical to the functioning of all these interfaces is a database queuing structure and billing database integrated with the communications provider.

Communications

The communications aggregator masks the complexities of local wireless networks and enables a single telematics device to operate across a wide geographic area. Communications transports vary widely from region to region. In the US, because of its broad coverage (reaching 99% of the population), the transport phenomenon of choice is cellular control channel. Canadians benefit from a more unified standard of wireless communications, and GSM (using SMS or GPRS) is popular for telematics services (although the footprint is still smaller than cellular control channel). In Mexico and South America the role of aggregator is less well defined, but some US aggregators—based on success in the US—are attempting to solidify coverage in all of the Americas at once. Abroad, communications may be based on GSM (with or without SMS), GPRS, iDEN, CDMA2000, or other standards.

Technical capabilities, reliability and footprint are big considerations when choosing a communications aggregator—but the most important consideration is the pricing model. Because of the underlying carrier costs, these aggregators always charge both a monthly fee and a per-communication fee. The compelling case for cellular control channel stems from its low monthly cost and low per-communication fees. SMS over GSM has a low per-communication cost, but may cost four times as much as cellular control channel on a monthly basis. GPRS has the lowest per-communication cost of all, and the highest monthly commitment as well. As a result, high-volume fleet tracking and fleet communications has made extensive use of GPRS, while consumer offerings have experienced high stickiness with respect to the low monthly price of control channel.

The communications provider works with the hardware manufacturer to certify the device, and provides programmatic interfaces to the other service providers.

Call Center: Stolen Vehicle recovery and Roadside Assistance

Call centers are the human face of the service. Economics dictates that the user have less human interaction with the commercially viable consumer telematics service than with OnStar. Still, for some situations human interaction is essential: giving roadside assistance to a person with a dead battery in a dangerous neighborhood, for example; or coordinating with law enforcement to recover a stolen vehicle. And although the device manufacturers are achieving ever-higher reliability, there are still technical support questions to answer when the device or a service provider malfunctions. With a prepaid service, most billing issues are handled self-service, but there remain monthly billing scenarios and—although billing issues are resolved more quickly than technical issues—there will always be some administrative support burden that must be handled by operators over the phone. Call center operations are added late in the service design, but costs must be estimated and factored in early. Call centers either use an interface provided by another partner, or layer their own interface on top of it.

PSAPs (Public Safety Answering Points)

Public Safety Answering Points (PSAPs) and the law enforcement agencies they work with are the backbone of stolen vehicle recovery. Although LoJack and other stolen vehicle recovery systems tout high vehicle recovery rates, the statistics don't reveal the state of most vehicles that are recovered. A large percentage of vehicles are reported stolen several hours (or even days) after the fact. In those cases, what the police recover for the consumer is the shell of a vehicle that has been stripped of everything of value (except for perhaps the tracking device). With the new consumer telematics offerings, the vehicle notices it's been stolen and alerts the vehicle owner immediately (similar to the new LoJack Early Warning product). The vehicle owner files a police report, and the call center coordinates with the PSAP to initiate recovery. In parallel, in the best stolen vehicle recovery systems, a control is sent to the device in the vehicle to disable the starter. That way, when the stolen vehicle comes to rest, the call center is notified that the vehicle has stopped; the starter is disabled; and police (with a proper stolen vehicle report) can recover the stationary vehicle without a high-speed chase.

Mapping and Location-Based Services

Vehicle tracking is sometimes described simply as 'putting a dot on a map', and--for a consumer offering--the better the map, the better the service. In addition to simple maps, other location-based services are being incorporated into consumer telematics offerings, including turn-by-turn directions, point of interest management, and business locators. Although the low-cost consumer offering will not include a visual display in the near future, this type of information may be presented more safely and effectively through a hands-free voice interface—which is feasible with today's infrastructure.

Distribution (Brand) Partners

While the hardware and services providers do the 'real' work, the brand partner identifies the market and brings the device and service to market as an integrated product. The biggest brands for true consumer telematics in the U.S. are the automotive aftermarket brands. Audiovox (with Prestige and Code Alarm), Directed Electronics (with Clifford, Viper, Automate), Clarion and Delphi are some examples.

Other brands can be combined with the brand of hardware to cement the channel all the way to the consumer. The best example is the 'big box' consumer electronics retailers: Circuit City, Best Buy and Good Guys are examples in the U.S. These brands are even stronger than the aftermarket automotive brands, and—although they provide very little in the way of direct service or support—the brand promise is sufficient to recommend an entire class of products to consumers. Satellite radio was launched almost exclusively through this channel.

Consumer telematics devices may also be sold through 12-volt shops such as Al & Ed's, AutoZone and other regionally popular shops catering to the 'do-it-yourself' crowd.

Although much less invested in brand, auto dealers and the supporting network of expediters has great potential to accelerate introduction of consumer telematics in many areas. This is because auto dealers achieve their largest margins on accessories whose market value has not been widely established. New vehicle options are typically introduced through the aftermarket. At that point they migrate upstream to dealers, where they boost profit margins until one of two things happens. Either the price becomes so well known to buyers of the option that consumers are unwilling to pay dealers for the option (take multi-disc CD changers, for example, which are still available from the dealer as an $800 option but easily obtainable from the 'big box' stores for much less than half the price). Or the original equipment manufacturers (OEMs)—that is, the automakers—determine that they may profitably differentiate the option as a factory-installed product, in which case the option migrates further upstream to contribute to the OEM's bottom line (for example, in-vehicle visual navigation systems are differentiated by their seamless integration into the styling of the dashboard—adding enough value to the option to ensure that Palm Pilot-based 'add-ons' will never be marketed to luxury auto buyers). Expediters are the group of itinerant mercenaries that travel from dealer to dealer, evaluating options sales and installing sets of options on vehicles on the car lot.

In addition to providing marketing, advertising and inventory management, the distribution partner is also the link to the other contributors in the value chain. The big box retailers and 12-volt shops have their own sales teams, finance officers, installers and customer support teams that integrate upwards into the distribution and service partners.

Section II: Challenges: Why Has Consumer Telematics Come About So Slowly?

If consumer telematics is such a great technology, then why didn't it take off during the period of explosive economic growth from 1997-2000? The combination of price and feature set was completely feasible in 1997, and the dot-com boom had put significant disposable income in the pockets of young professionals. Television disk recorders (think TiVo and ReplayTV) and the iPod (and a host of other high-end MP3 players) made their debut and became successful during the boom. But consumer telematics wasn't ready. As we'll see, several factors combined to retard the development of the offering and slow the path to market.

WingCast's Rise and Fall

A lot has been made of the impact of WingCast on the consumer telematics industry. A quick history of Wingcast is called for:

- January 2000, Ford CEO Jacques Nasser announced the formation of a new business unit dedicated to a new telematics offering, with several features (as the following examples from Infiniti's business plan indicate):
    - Airbag deployment notification
    - Emergency assistance
    - Stolen vehicle tracking
    - Hands-free calling, call forwarding and voicemail
    - Information services (all-Internet)
    - Navigation services
    - Full voice-activated interface
- In October 2000, Ford and Qualcomm jointly financed the creation of a new company
- June 2002, Wingcast was gone.

What went wrong? Was it bad market timing for telematics? Probably not. Most likely, Ford management saw that the window of economic opportunity for such an ambitious project was closing. Rather than under deliver with a smaller budget, Ford did the appropriate thing (having learned its lesson from 1970's projects like the 'Mustang II') and pulled the plug altogether. It's a good thing, probably, since consumers would not have likely accepted a Wingcast-branded Internet portal in the vehicle. (Evidence of this is that Microsoft is finally being let into the automobile—in a slow, measured fashion--to present a trusted 'informatics' brand in the vehicle to consumers.)

Wingcast's splashy arrival on the scene with an enormous budget effectively put the lid on investment in competing research and development. As a result, when Wingcast failed, the players that had until then struggled to survive were left with a market opportunity and no resources to exploit it. As we'll see, it has taken until now to roll the available capital investment into a critical mass of companies to develop the less-ambitious but sustainable product that lingered in Wingcast's shadow for two years.

But the delay to market of consumer telematics solutions cannot be blamed entirely on Wingcast. Technical, marketing and usability issues plagued early offerings.

Communications Issues

Cell phones have been embedded in vehicles for some time. More recently, GPS devices have been ruggedized and price-reduced such that they are inexpensive enough to deploy. Even more recently have the two been married such that both could work together reliably.
The single biggest issue with communications development has come with firmware programming of the radio to communicate with the carrier networks. Wireless communications networks in the U.S. are notoriously varied, and building a device that communicates reliably over cellular control channel from region to region is a complex task. One example of such a hiccup: Standard Communications (now Skybility), maker of the radio component being used in several solutions, discontinued their successful 8600 model number and released the 8700 model—which at first performed very poorly in the field. The problem, since corrected, was due to firmware changes that were made to accommodate a new, design, necessitated by parts availability in the supply chain.

Billing

Because the typical telematics device contains a cell phone which has to be powered on continuously, the costs of running such a service can be modeled on cell phone communications costs. And up until the last few years, the only way to buy cell phone service was to pay a monthly bill. However since the user interface for consumer telematics devices is different from cell phones, consumers don't expect to have to pay monthly for a service associated with an automobile. Still, early service providers—in order to reduce exposure to communications costs—attempted to market a service that had a prepaid portion and a monthly overage billed after-the-fact. This billing model proved too cumbersome: it was inconvenient for the consumer and very expensive for the service provider (billing ends up being a substantial portion of the cost of the service).

Some service providers attempted to solve this problem by providing ‘all-you-can-eat’ annual service plans.

Because very little is known about use patterns, service providers who offer ‘all-you-can-eat’ are working off of one of two strategies: either they are using the service as a test balloon to gather use data for more accurate future pricing, or they are attempting to demonstrate the viability of the service in time to get bought out by a larger (potentially OEM) player. Providers who have gone this route may have miscalculated, since not a single OEM has elected to spend money on a telematics unit that is losing money hand-over-fist.

We’ll see that the sustainable solution has been demonstrated to be a pure prepay model, where the service provider gets paid up front, and the consumer’s use of the service is metered (and does expire) over time.

GPS Installation and Testing Issues

Releasing a new product that must be integrated into a vehicle’s electrical system is in itself a challenge. Although the hardware and service may be engineered to the highest standards, if the telematics device is improperly installed, the consumer may still have a bad experience with the product. Typical aftermarket security accessories involve connecting power, ground, ignition and relays to lock and unlock the doors. Location-aware telematics devices also require cellular and GPS antennas to be tucked away in a functional yet inconspicuous way. This problem was not encountered with traditional fleet solutions, since the antennae were always clearly mounted with a magnetic mount on the roof of the truck cab. Consumer solutions demand a higher aesthetic, and should not be conspicuous to thieves either.

The location of the GPS antenna has been most problematic. Most GPS receivers function well when the GPS antenna has a clear view of the sky, blocked by (at most) glass, plastic or wood. When the installer attempts to hide the antenna in the vehicle, though, he may not know whether the dash, rear deck or windshield contains metal. Only after testing the GPS does the installer know whether he has it right. Some installers test the installation by connecting various diagnostic tools to the device to determine how many satellite signals the device is able to lock in.

An even better solution is to provide an end-to-end test of the entire system similar to the consumer’s experience: once the installer has hidden the antennae in the vehicle, he calls into a voice user interface and initiates a ping of the vehicle for location. If successful, he hears the address of the vehicle read back to him over the phone. This type of test is simple and easy to execute; it tests not only GPS accuracy but also two-way communication with the device.

Further tests are desirable if the product is designed to operate outputs (such as door lock, unlock or starter disable) or transmit based on inputs (from alarms, speed sensors, impact sensors or other logic or diagnostic engines in the vehicle). Only recently have the leading services implemented full installer test programs.

Lack of Coordinated Brand Introduction

While Ford’s Wingcast brand would likely have carried a lot of weight with OEM’s, dealers and consumers around the world, the fledgling consumer telematics solutions suffered from insufficient brand recognition. Given that the product costs $700, will be installed in and interoperate with a $40,000 personal asset, and supposedly lasts at least five years; what consumer is going to buy ’TrakGuard’ from ‘Secure Technologies’ with no customer references?
Why have the major aftermarket brands been so slow to launch? A combination of risk and lack of incentive is the reason: a large brand like Audiovox does not want to risk an early launch for fear that the product will fail to meet expectations. Also, as long as there is no other competing product widely available to threaten the brand, why take the risk?

Confusion About the Role of Vehicle Monitoring

Automakers have been looking for ways to enhance their relationships with customers beyond the vehicle purchase for a long time. Extended warranty programs, car clubs, magazines and free services are all examples of this. Onboard diagnostics (OBD) were initially conceived as a way to enhance service effectiveness in the field, but have come to play a role in the customer relationship as well. From the point of view of the automaker, telematics is poised to completely close this loop. By installing location awareness in the vehicle at time of manufacture, the automaker never completely releases the vehicle. It may be repossessed, recalled, analyzed, diagnosed, advertised or marketed to at any time. Consumers don't see this as a benefit, however. Automaker or dealer presence in the vehicle post-purchase is not acceptable to consumer advocacy groups or consumers. The idea of a corporate Big Brother analyzing driving patterns, selling location and behavior information (even in aggregate) to retailers, or providing information to the government under legislation like the Patriot Act leaves consumers cold.
The challenge to aftermarket telematics service providers is to provide adequate assurance of privacy, and to produce a pricing model that is profitable without selling consumer data. The twin challenge is to maintain enough of a relationship with the auto dealer channel that new car sales continue to drive the purchase of telematics devices.

Price

Initially, pricing of telematics offerings was based on monitoring for fleet services. In the fleet tracking business, service fees of $60 per month are common, with initial outlay for hardware in the $1,000-$2,000 range. The high monthly cost is a result of the requirement of fleet managers to keep accurate reports of stops, starts and waypoints along routes. Clearly, most consumers wouldn't sign up for a service for their car that is on the same order of magnitude as their utility bills. And although they expect the service to work when they need it, most consumers don't require the constant monitoring, record-keeping and reporting that fleet managers need.

In some sense, too, providing telematics to fleet managers is an easy business proposition. Even with a small fleet of, say, 100 vehicles, the solution provider is managing a $100,000 account, which allows room for account management, high-level escalation of issues and resource allocation to solve problems. With a consumer offering, support costs per revenue dollar are much higher, because each account is a single user who spent $700 of his disposable income. Getting the price of the total solution down from the fleet space to the consumer space has not been easy.

Power Management

Consumers often take power for granted in an automotive application. However it has been difficult to implement an 'always available' telematics solution for vehicles. Consider the owner of a handheld wireless phone and handheld GPS. When the battery on his mobile phone starts to get low, he may turn it off except to check messages and make incoming calls. He turns off his handheld GPS except when he's using it. Also, these two devices operate off two independent power supplies, so he may still be able to make an emergency call even though the battery on his GPS is dead.

Now imagine the same components in a vehicle, without the benefit of a decision-making human in charge. If both components always stay on, then the vehicle battery will drain very quickly and the 'convenience' user gives up on the device. If power to the wireless radio is cycled, then the device is not available to receive commands 100% of the time. Now the safety user who wants to be able to unlock the doors remotely is dissatisfied with the device. Some power is saved if the GPS is only turned on when necessary. But then the efficacy of features like 'Perimeter violation' is compromised due to the lower timing resolution on boundary violation detection.

Most device designs now make use of several power modes (e.g., full-power, GPS-off, radio cycling and timer-only) and transitions between modes triggered by timers, battery voltage, ignition state and pre-determined events. Still, vehicle electrical system performance varies widely with age and from climate to climate. Device manufacturers are still improving power management to take this variation into account.

Section III: Convergence: Breakthroughs That Made a Difference

No single event caused the current array of internationally branded telematics offerings to be successful; in part, many of the problems mentioned above have been addressed. At the same time, independent developments fostered the convergence we've seen in the last twelve months.

Consumer Perceptions: Zeroing in on the Space between LoJack and OnStar

Comparison of LoJack and OnStar
Since LoJack was first offered 17 years ago, the concept of a consumer-friendly, remote monitoring service for vehicles has steadily gained ground. With the announcement of OnStar in 1996, a new category was born: in-vehicle concierge and emergency assistance. These two brands represent the two poles of consumer awareness of telematics. From a features perspective, LoJack is like an insurance policy. You never have to deal with LoJack until your car is stolen, and then LoJack gets it back for you. LoJack touts a 90+% recovery rate, which is a significant improvement over the 60+% recovery rate of stolen vehicles nationwide.

OnStar is all about service—maintaining a constant presence in the vehicle (the little button on the rearview mirror with 'On' on it). It's a customized service with a human interface that's always available. Since the price of both products is typically rolled into the price of a new vehicle, there is little price awareness initially—but after the first year the difference is clear: LoJack service is included for the life of the vehicle whereas OnStar customers pay a monthly fee (recently between $17 and $70 for extended in-vehicle talk time) to renew the service.
So on the one hand you have LoJack, which offers no-frills stolen vehicle recovery at a relatively low price—and on the other hand you have OnStar, which offers a rich, human interface at a price rivaling today's wireless phone plans.

Splitting the Middle
The emerging successful products offer the consumer the best of both worlds: an extended, use-it-now feature set at a low price. Consumers have intuited the gap for some time, and a branded offering that fills that gap—available at the dealer or as an aftermarket accessory—is experiencing high adoption rates.

Finding the Correct Buying Rationale

The idea of an 'infinite range' remote control coupled with real-time tracking and notification has enormous cool factor for car crazies and gadget freaks. At car shows, in dealerships, on street corners, everybody wants to show off the automobile as omnipresent extension of self. What better way to do this than to call your car to set the alarm and get a position report?

Early reaction from this market segment led marketers of the early offerings to false conclusions about the mass market. They positioned the product to sell based on these cool factors. It took some time for marketing to realize that buyers *look* because they think tracking your vehicle online and unlocking your doors with your cell phone is cool; but they *justify the purchase* because of the safety and security of valuable assets and loved ones. Gearing the product that links together the cool factor *and* the reason to buy has been tricky, but today's marketing focuses on *telling* buyers the benefits while *showing* them the features.

Case in point: the marketing literature and point-of-purchase DVD for the Viper GPS Tracking System: the images show communications satellites and a glitzy interface, while the text reads, "Find It…Track It…Get it Back!"

Satellite Radio

In late 2001 when XM Satellite Radio launched the first consumer satellite radio service, analysts were pessimistic about the long-term viability of the service. The high cost of launching and maintaining powerful broadcast satellites in geostationary orbits, the challenge of building an independent brand from the ground up, the resistance of entrenched lobbies for analog, terrestrial broadcast systems—all these things needed to be overcome in order to succeed.

The subsequent success of satellite radio (XM has achieved success, anyway—not so clear is whether this market will be large enough for competition) is important to telematics for several reasons. First, it establishes the first reliable, mass-market vehicle-based service delivery since the sale of gasoline. It's now clear (with over 700,000 paying customers for XM alone) that consumers are willing to pay for 'in-car cable'.

Second, the success of satellite radio validates the pricing model that is crucial to telematics: the radio receiver is purchased as an aftermarket, big-box consumer accessory or as a packaged vehicle option at the dealer. At between $100 and $200 (plus installation), the receiver is priced inexpensively to drive volumes, while kickbacks from new subscriptions flow to hardware manufacturers.

Third, satellite radio has prepared the consumer electronics channel to sell electronics that are tied to branded services. This starts with education of the sales force, which had not previously needed to recommend a service (for example, one cable company over another) in order to sell a product. It will extend eventually to the salesperson, who will shortly be able to sell an extended subscription to a consumer in the store (for a sales spiff, of course).

The success of satellite radio has primed consumer electronics retailers for the 'next big thing'. As they see satellite radio take off in new non-vehicle applications (you can buy satellite radio for your home or pocket stereo now as well as your car), they are looking for other product/service combinations that follow a similar model—and telematics is an obvious choice.

Establishing the Correct Consumer Expectation

Consumer adoption of new technologies is driven partially by a degree of understanding the limitations of such systems. The last thing companies want to do is release products that fail to live up to the hype. Product shortcomings, when well understood, drive intelligent choices by consumers. An example of a product that had a very difficult rollout as a result of misunderstanding was the MiniDisc player/recorder. MiniDisc was promised to delivery high quality sound on a recordable medium. The only problem was that people didn't realize the limitations of magnetic versus optical recording technology—they expected CD-quality sound with the capability to record. Of course, most people can hear the difference between MiniDisc recordings and CD recordings. So the product caused great consumer frustration until it was placed in its proper niche: high-capacity, portable recording comparable to CD but an order of magnitude less expensive than DAT (Digital Audio Tape).

Consumers best understand Telematics products as a cross between a mobile phone and a GPS navigation unit. From experience with these types of products, consumers have a baseline from which to gauge performance and understand the parameters that affect performance.

With wireless phones, consumers in the US know that the type of carrier and network supported by the phone determines the coverage area and reliability of the service. So, if a telematics device uses the same network as a cell phone does while analog roaming, then it should work throughout most of the countryside as well as in the city. However if the device uses only digital networks and cannot roam, the coverage will be poor in the countryside.

With GPS it's a similar story. Consumers who have used in-vehicle navigation or stand-alone GPS units (like the Garmin units popular with outdoorsmen) know that GPS signals are very weak indoors or underground. Users of telematics devices are not surprised when their vehicle always appears to be at the door of the parking garage rather than inside the garage.

The last class of issues that consumers are aware of is power management issues. Most users are familiar with what happens when they leave an accessory plugged into a power outlet in their vehicle over a weekend—it kills their battery. Telematics devices are designed to be sensitive to a vehicle's power supply—so most devices power themselves down rather than risk causing the vehicle not to start. Consumers can understand and appreciate this in the event they are not able to locate their vehicle because the telematics device has entered a power conservation mode.

Problems with telematics devices are being solved every day—but where problems persist the performance can be easily understood in terms of devices that consumers experience every day.

Maturity of Team and Ecosystem

Delivering a complete telematics product takes a number of contributors. As we've seen in the foregoing discussion, several partners work together to deliver the hardware, service and support. During the dot-com boom many new companies struggled to dominate a specific niche by erecting barriers to entry for others.

Companies slandered one another, and disputed claims of intellectual property, and jeopardized competitors' relationships with other links in the value chain. This made collaboration among the various links difficult.

More recently, in most of the categories of contributor, specific companies have emerged with stable, more mature offerings that lead the rest of the group. The difference between the leaders and the rest can typically be characterized in one of the following ways:

- Intellectual property: now that the patents of the late 90's have finally been granted, the claims, dates and stakes of all entities are more easily verified
- Flexibility: device and software manufactures that favored an adaptive, flexible architecture early on are now reaping the rewards: CSI Wireless in hardware is known for making a highly programmable 'brain', and Telcontar's UTS delivers a very modular back-end software service that accommodates any device and communications protocol
- Low cost: manufacturers like Aircept have worked very hard to be a year ahead of every other manufacturer on price—having sustained this trend for a period of years, Aircept can be counted on to continue this focus
- Financial backing: some players have achieved market share by partnering with an umbrella organization with deep pockets

Whatever the reasons for the pruning and promotion of some organizations, the effect is that core teams made up of the prevailing 'winners' can now operate together without great concern for the long-term health of the other partners.

Introducing a Big Aftermarket Brand

Early adopter offerings appear often under a no-name brand. However the mass-market is wary of no-name brands: they tend to be financially insecure offerings that may go away at any time. Although there are good deals in this space, a mature consumer will not buy a safety and security product from a company he has never heard of.

Thus when Directed Electronics announced the marketing of its GPS Tracking System under its best-selling brands (Viper, Python, Clifford and Automate), there were two effects: First, the release legitimized telematics products in general. This has helped some of the no-name brands in markets where the strong brand was not available, or where service was spotty. However in instances where the no-name brand was selling through a channel with ties to the Directed, Directed was able to completely displace the no-name brand in the channel. Second, the release stimulated the announcement and release of telematics units under other big brands. As of this writing, Audiovox has made a commitment to release a competitive telematics unit under its popular Code and Prestige brands.

The presence of increasing numbers of products from the big car alarm brands increases consumer confidence in the product category; and the market travels down the adoption curve as manufacturing volumes increase and prices decrease.

Cost Efficiencies Driven by Fleet Solutions

Consumer telematics offerings did not come into existence out of a vacuum. For years, fleet owners have been subscribing to vehicle tracking and monitoring services like AtRoad and FleetBoss, the two Canadian leaders in this space. Out of this industry came the original cost efficiencies that made a consumer offering possible. The integration of radio and GPS components in a ruggedized fashion, antenna technology and the advanced power management of today's consumer devices can be traced directly to the fleet devices.
Subsequently, some fleet solutions have morphed either into workforce management applications or into more consumer-friendly solutions.

Finding the Correct Pricing Model
The first wave of consumer telematics products struggled for want of a clear way of collecting revenue from consumers. Some attempted to bundle the lifetime cost of the service into the cost of the device. Without a new vehicle purchase, this is expensive and in any case those early offerings proved so damaging to businesses that offered them that none exist today. Beyond that, some solutions based on monthly or yearly subscription have done tolerably well. The idea with monthly billing is that the service itself becomes easy to deliver—it never needs to be restricted according to complex business rules because the user decides what and how much they want to use, and the system just records it and bills for it. The largest cost and complexity is in billing the end-user each period.

Still, getting paid after the fact has problems: variable cost exposure and the high costs of collecting revenue threaten the long-term viability of these offerings. The breakthrough for the sustainable revenue model was prepaid usage. With prepaid usage, the complexity and cost shifts from billing to access control. In order to construct viable access control, the following problems were overcome:
- How do you restrict access?
- How do you control fixed and variable costs without permanently disabling the device?
- How do you decide which users to let go and which users to keep?
- How do you gracefully terminate users?

A flexible system with configurable business rules is required to address these issues—and the result is a solution that is predictable and easy to use while not costing too much to operate.

Summary

With healthy competition among a set of established national brands, the consumer telematics industry is poised for accelerated growth. This paper accomplishes two goals: it describes and categorizes the successful consumer telematics solutions available today, and it explains the environment and influences that led to those solutions.

Today's consumer telematics solutions, sold in North America, have a market-tested combination of safety, convenience and security features that will set a worldwide standard for the industry. Those solutions are supported by a maturing value chain of communications, brand, hardware and software solution providers.
The path to success for these complete products has required the solution of technical, marketing and business process problems by a combined team of companies with the common objective of strengthening the industry as a whole. As well, some key developments in the environment have caused the current solutions to fall into the right place at the right time: changing consumer perceptions, realistic pricing models, lower-cost hardware, introduction of major national brands and enhanced cooperation among members of the maturing value chain.

References
Most of the information in this paper is gleaned from business experience over a period of several years as the consumer telematics industry has matured. Specific sources are also cited below.

ABI Research Group, "Aftermarket Telematics Study", 2003

BusinessWeek, “Big Boom, Weak Profits” August 2, 2002
Driscoll-Wolfe, “Wireless Location-Based Services”, 2003
CIO Insight, “How Ford Motor Company Got Back on Track”, January 14, 2003
Qualcomm Annual Report for 2000
Pulver.com’s August 2002 LBS Report