Connectivity shifts the power in the automotive industry
Executive summary

Consumers are increasingly demanding technologies that improve the efficiency, the safety and the entertainment within a car. The Internet of Things is becoming mainstream and users are demanding full time connectivity and updates, parameter monitoring and remote controlling. All these trends are putting increased pressure on automobile industry to adapt traditional car manufacturing lifecycles. From the drawing board to hitting the road, a car development will take roughly four years. In the same time, Apple will have released four iPhone generations. As cars become more and more an extension of the digital space, they will need to adapt to the lifecycle imposed by software companies.

Connected cars are defined in this paper as vehicles with broadband connectivity to the World Wide Web. The next models will also connect to the infrastructure grid (such as other vehicles, parking lots, electricity chargers, traffic lights). There is a clear distinction in technology and advancement to self-driving cars. The cars of the future will very likely exhibit both autonomous behavior and constant connectivity.

The value chain of partners has been significantly changing in the past years as technology providers have entered the car industry. As the time we spend in cars has been steadily increasing\(^1\), the digital business opportunities are diversifying. The paper explores both the value to be created throughout the ecosystem, but also touches on the main challenges that still pose problems and slow adoption. There is a need of co-innovation especially for governments and regulators, who are working on setting new safety and technology standards and rules for the car industry.

Among automobile constructors, competition is fierce. Margins shrink despite consolidation and only the major conglomerates remain profitable. They are chasing efficiency pushed by low-cost manufacturers from BRICS economies (Tata). There is innovation pressure to adopt new power technologies (e.g electric engines) from new entrants (Tesla). Unconventional competition entered the space: the tech companies (Google, Apple, Microsoft) and telecom providers. Tech companies are developing in-house competencies and are challenging the leadership of this industry. The paper explores the arguments in favor of tech companies taking the helm of the ecosystem. To unlock and capture the value, these companies will still need to solve some adoption issues such as standards, privacy and security, road regulations.

Smart connected cars are coming and possibly becoming a reality by 2025!

A definition of connected cars

The first and most important question to address is “what is a connected car”. It is frequent that the connected cars and autonomous cars become wrongly interchangeable words defining the car of the future. That car will be both: highly connected to the World Wide Web and other infrastructure players (such as cars, parking lots, electricity charges) and also autonomous. However, the two have different but convergent paths.

Connected cars evolution path will probably include the following milestones:

- **Horizon 1:** Basic forms of connectivity: entertainment, assistance, oversight
  - Music/audio playing, smartphone apps, navigation, roadside assistance, voice commands, contextual help/offers, parking apps, engine controls and car diagnosis, location, miles/kilometers, speed.
  - Examples of companies active in this space: Tesla, ZipCar, Hertz, Toyota.

- **Horizon 2:** The car becomes an additional display for apps and content consumption
  - The app experience is replicated inside the car, but modified to be safe and not distracting the driver. New apps are built based on car APIs.
  - Examples of companies: Open Automotive Alliance (founding companies: Audi, GM, Google, Honda, Hyundai and NVIDIA).

- **Horizon 3:** Car-to-Car connectivity
  - Cars will connect to each other and to infrastructure elements (such as charging stations, parking lots, traffic lights). They will take decisions to optimize resources and comfort for passengers based on their destinations.
  - Examples of companies: Car 2 Car Communication Consortium (European car manufacturers, technology companies, universities)
In parallel, the autonomous cars development range across four levels in the US, as classified by the National Highway Traffic Safety Administration (NHTSA):

**Level 0:** The driver completely controls the vehicle at all times.

**Level 1:** Individual vehicle controls are automated, such as electronic stability control or automatic braking.

**Level 2:** At least two controls can be automated in unison, such as adaptive cruise control in combination with lane keeping.

**Level 3:** The driver can fully cede control of all safety-critical functions in certain conditions. The car senses when conditions require the driver to retake control and provides a "sufficiently comfortable transition time" for the driver to do so.

**Level 4:** The vehicle performs all safety-critical functions for the entire trip, with the driver not expected to control the vehicle at any time. As this vehicle would control all functions from start to stop, including all parking functions, it could include unoccupied cars.²

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This paper is looking to address the imminent uptake of Horizon 2. The reason is that today’s market is just ramping up on Horizon 1 vehicles and Horizon 2 is in actual making. Therefore, due to the amount of technical incertitude concerning the Horizons 2 and 3, it is reasonable to limit the scope to the former.

Changes in the industry

The existing industry value chain can be simplified and summarized the following way:

- The backbone:
  - Parts suppliers: companies commissioned by car manufacturers to produce individual parts as per a given design and specifications (includes aftermarket parts);
  - Car manufacturers: design and develop mass market production of automobiles; they hold the brands recognized by the customers;
  - Dealerships: the distribution network for cars;
  - Customers: end-users of transportation means and infrastructure;
  - After sales services: maintenance and repairs workshops
- Other auxiliary players and influencers:
  - Insurance companies: coverage, in the form of compensation resulting from loss, damages, injury, treatment or hardship in exchange for premium payments;
  - Cross-sell services: independent companies that install and maintain additional equipment (not necessarily OEM) and services – e.g. tuning, upgrades, HD radio, updated maps, charging stations;
  - Government regulators: authorities responsible of standards for vehicles, infrastructure and environment (they also provide a large part of the infrastructure – out of scope);
Connected cars open the door for technology providers to enter this space, partnering with many of the existing industry participants.

- **IT companies**: large tech companies such as Google, Apple, Microsoft, Alibaba have started providing different products and services to car manufacturers, focused primarily on car entertainment and navigation systems;
- **Telecom providers**: Verizon and AT&T in the US are two examples of telecom providers of services for connected cars and platforms;
- **App developers**: users can nowadays stream Pandora music, update their Facebook status, shop on Amazon (and many other) from the comfort of their car\(^3\) – more apps coming to car screens are inevitable;

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\(^3\) [http://www.bmwusa.com/standard/content/innovations/bmwconnecteddrive/connecteddrive.aspx](http://www.bmwusa.com/standard/content/innovations/bmwconnecteddrive/connecteddrive.aspx)
New value in the ecosystem

In this new automobile ecosystem, additional value will be created and perceived across existing and new players, but at different levels – represented in the ecosystem map below. The clear winners will most likely be the car manufacturers and the technology providers.

The paper explores the different levels of value perception from high to low.

*The highest value*

The most value (in green) is will be perceived by constructors through the differentiation potential of connected cars. Also technology providers and auxiliary services providers are direct benefitees of hyper-connectivity as connected cars represent a completely new market for digital products.

*Case in point for manufacturers: Chevrolet brings 4G LTE Wi-Fi to cars*

Chevrolet’s marketing claim is that they are the “first and only car company to bring built-in 4G LTE Wi-Fi to cars”. GM and AT&T announced during the Consumer Electronics Show (CES) in Las Vegas 2014 their
partnership to bring 4G connectivity on most 2015 Chevrolet models.\(^4\) Since then they have been running advertising campaigns including 2015 SuperBowl Chevrolet Colorado Wi-Fi commercial.\(^5\)

Chevrolets efforts are responding to clear customer insights. In September 2014, AT&T Drive Studio and Ericsson released Global Study on connected cars’ buyers’ preferences and purchase decisions drivers. Among the findings were the following three aspects:

- “Half of all drivers surveyed worldwide would switch brands to a comparable brand to get Connected Car services.
- 72% of drivers would delay a car purchase by one year to buy a car with connected Car services from their preferred brand.
- 67% of U.S. drivers indicated they would probably or definitely buy connectivity or Wi-Fi service if available in their car.”\(^6\)

\(^5\) [https://www.youtube.com/watch?v=hHS4Z6cnN8A](https://www.youtube.com/watch?v=hHS4Z6cnN8A)
\(^6\) [http://about.att.com/story/Aatt_drive_studio_and_ericsson_release_global_study_on_connected_car_buyers.html](http://about.att.com/story/Aatt_drive_studio_and_ericsson_release_global_study_on_connected_car_buyers.html)
Case in point for technology providers (1): AT&T Drive integrated with AT&T Digital life

AT&T was probably not the first name that came in consumer’s mind when thinking of smart homes or cars. However, the company has been actively investing in developing a platform for home monitoring and remote access, which was marketed directly to consumers. In the same time, they have partnered with car manufacturers (such as GM, as shown above) to bring AT&T Drive services to vehicles. Now they are aiming to build a strong competitive advantage amongst telecom (and technology) providers by combining the two services:

“The integration means the Digital Life app can be accessed through the dashboard control panel or voice recognition of a participating connected car, linking customers to their automation and security features including, door locks, lighting, thermostat and the garage door”.7

Case in point for technology providers (2): 'Verizon Vehicle' retrofits vehicles

Verizon Vehicle addresses a market of 200M unconnected cars to add them to the grid for $15/month. Their product is a simple plug-in to the car system through the On-Board Diagnostic (OBD) reader ports and it works on more than 9000 vehicle types. It allows users to track the position of the vehicle through GPS, send accident notifications, transmit data of vehicle’s condition and provide auxiliary services such as voice calls, email, text messages, push notifications.8

While the Verizon retrofit solution seems more technically limited that AT&Ts, it is very interesting as it could bring into the grid a large market of existing vehicles.

7 http://about.att.com/story/att_integrates_home_security_and_automation_controls_with_the_connected_car.html
Case in point for technology providers (3): Chinese e-Commerce giant Alibaba to develop the “car on the Internet”

In the technology provider category, the companies mentioned most often to potentially develop the cars of the future are Google and Apple. However, industry analysts should pay attention also to Chinese internet giants such as Baidu, Tencent and Alibaba. The most recent to announce aspirations in the connected car area is Alibaba who is partnering with SAIC Motor Corp to develop internet-connect vehicles. If Xiaomi’s success is any indicator of local companies’ ability to innovate and offer low priced technology to masses, then Alibaba holds a good chance to become an important player in the digital car area.

Medium value
At the next level (represented in orange on the diagram), the value perceived by consumers depends on the trade-offs they will have to accept. Insurance companies could benefit from more control over the insured assets; however, the new technologies will represent an unmeasured risk that will affect their business. Part of the backbone of the value chain, after sales service and repair centers will have to assess what is the value of servicing new technologies additional to typical mechanics and electronics cars have been having. Similarly, governments will experience advantages and disadvantages of overseeing connected cars.

Case in point for insurance companies: Telematics as new data points

Insurance companies are seeking to understand better their customers and personalize the products based on driving behavior. Insurers have created policies that include plug-and-play devices to gather telematics information from consumers advertising discounts for safe drivers. The typical data gathered by providers like Progressive through the Snapshot device are Vehicle Identification Number, miles driven,

9 http://www.hybridcars.com/chinese-tech-billionaire-delving-into-internet-connected-electric-cars/
time and day, hard brakes, location (on some devices).\textsuperscript{12} Despite technology issues like battery drainage\textsuperscript{13}, these programs are gaining in popularity: Progressive Snapshot’s sales have grown by 28% in 2014\textsuperscript{14}. The reverse of the medal are the rate increases based on hard braking habits – how is “hard braking” defined (a rate-of-speed decrease higher than of 7 mph per second) is another question that customers often do not understand or agree with\textsuperscript{15}. We could potentially see in the future the concept of black box from aviation applied to cars, where insurers could determine with exactitude the culprits of an accident.

While this is an opt-in program today, with the wide adoption of connected cars this information might become compulsory to sign-up for an insurance. The amount of information collected might also increase to record other personal data. This is will make the insurance companies even more exposed to data breaches where personal information could be lost.

**Case in point for Government regulators**

A recent (Feb 2015) study released by US Senator Ed Markey (D-MA) where 16 major car manufacturers had been surveys noted that there is a “clear lack of appropriate security measures to protect drivers against hackers who may be able to take control of a vehicle or against those who may wish to collect and use personal driver information”.\textsuperscript{16} In the meantime the US Department of Transportation (DOT) jointly with the National Highway Traffic Safety Administration (NHTSA), have published their research efforts to harmonize international standards and architecture around the vehicle platform.\textsuperscript{17}

The US DOT has announced working with the European Commission on these future standards. However, it is likely that the reach of these standards to be affected by fundamental differences in how the internet services and information distribution is viewed on the two sides of the Atlantic. Now this complexity could be extended to the car manufacturers.

\textsuperscript{12} http://www.progressive.com/snapshot/tdx/FAQGeneral/FAQ
\textsuperscript{13} http://gotaclassaction.com/progressive-insurance-named-in-class-action-lawsuit-over-its-snapshot-usage-based-insurance-program/
\textsuperscript{15} http://fiscalfizzle.com/2011/11/10/snapshot-discount-review/
\textsuperscript{17} http://its.dot.gov/research/harmonization.htm
Case in point for Consumers

Consumers are no doubt the most important in this ecosystem. They are discussed at the end because some of the value proposition they perceive has already been mentioned before.

As with many technologies, users will have to make a tradeoff between flexibility, privacy, security, money and new services (faster routes, nearest available parking spot, safety, entertainment, lower insurance rates). The recurrent question is what happens when users will no longer have the choice to opt-in. As with many other services, many of the users do not fully understand the conditions, risks and their responsibility to access such services.

One of the hot tech topics in the past 12 months has been cyber security (or the lack of it). The invasion of privacy is no longer from a short range, but it could come next from a country as far as Russia or China. Until now, people believed that their home and to an extent their car were safe private environments. However, connectivity opens ethical dilemmas of what is connected, what information is tracked and logged, hence becoming sensitive information.
For example, during the CyberAuto Challenge (March 2015) organized by auto manufacturers, policy makers and engineers to explore technical weaknesses of vehicles, a 14-year old student managed to connect to a vehicle with a homemade $15 device\(^\text{18}\). The fact that this was possible should alarm the car manufacturers to build the same competencies and adopt testing processes of high tech providers.

### The lowest value

Lastly in value perceived (represented in yellow) suppliers and distributors will benefit from the spill overs of the new technologies requirements and differentiation opportunities. However, we can assume their margins will remain similar as before.

### The new leadership of the industry

*Will the connected cars be the next smartphones?* Smartphone hardware is almost a tech commodity these days with little difference between devices, while all that matters for the consumers is the ecosystem (e.g. iOS, Android, Windows).

*Will the apps availability be more important than choosing between 1.6 or 2.3 L engine?*

*How important will it be for different devices (cars, house locks or lights, appliances, phones, sports trackers) to be integrated and communicate with each other?*

These questions might hint that IT companies could become the leaders of this ecosystem given the amount of consumer data already owned. They will steer the in-car user experience and part take in the revenue streams. The pre-requisite is for tech companies to solve the need for standardization and integration between numerous outstanding devices and technologies that have appeared in the market.

*Will the car companies be able to diversify technology providers and operating systems (similarly to laptops being able to run Windows or Linux OS), so that they tilt the bargaining power balance to their favor? Will they try to develop in-house software (like Samsung’s Tizen OS for TVs)? Will they add app stores allowing users to choose which apps they want to install? Will they use HTML5 to remain independent?*

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Will the car-to-car connectivity give an advantage to the auto industry?

There are certainly aspects in this leadership quest that could give an advantage to the incumbent players. However, there seem to be more arguments in the favor of technology players taking the helm of this ecosystem:

- From the standpoint of value added and potential issues, the connectivity of cars certainly looks similar to that of mobile phones. Thus, the power balance would tilt in favor of the IT companies, which explains their increased interest in entering the market.
- There are potential synergies with Artificial Intelligence powered cars (i.e. self-driving) that have been developed by both tech companies and car manufacturers.
- The tech companies have a history of disruptive innovations, hence the consumer perception is more flexible to new value propositions. However, the incumbent car manufacturers are less likely to take risks and more prone to innovate in small increments for the mass markets.
- The major tech companies have enough assets (both physical and intangible) to start innovating the car space from scratch just like Tesla did in the past years. Therefore, they could potentially grow the smart car capabilities fully in-house. They will not replace the car manufacturers completely but probably dictate much of the user experience customers will expect.
- For the moment, the car manufacturers hold the key to enter this space. If the tech providers are willing to share some of the user revenues, then some car manufacturers might be willing to carry Google’s or Alibaba’s car platforms.

Conclusion

In conclusion, while there are still many challenges to overcome, the new value created appeals to all value chain partners in different ways. As the technology and services are progressing, the questions asked throughout this paper will be incrementally answered.

From a technology perspective, the two main challenges in the quest for connected cars to become mainstream will be (1) how will tech companies answer solve the adoption hurdles and unlock the value and (2) who will be the first one to put the last piece in the puzzle and become market leader.
About the Center

The Glassmeyer/McNamee Center for Digital Strategies at the Tuck School of Business focuses on enabling business strategy and innovation. Digital strategies and information technologies that harness a company's unique competencies can push business strategy to a new level.

At the center, we foster intellectual leadership by forging a learning community of scholars, executives, and students focused on the role of digital strategies in creating competitive advantage in corporations and value chains. We accomplish this mission by conducting high-impact research; creating a dialog between CIOs and their functional executive colleagues; and driving an understanding of digital strategies into the MBA curriculum.

We fulfill our mission by concentrating on the three following areas:

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Connecting practice with scholarship anchored on IT enabled business strategy and processes.

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Convening roundtables focused on the role of the CIO to enable business strategy.

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Bringing digital strategies into the classroom through case development and experiential learning.