Master the Four Stages of Connected-Vehicle Evolution to Lead the Renaissance of the Automobile

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The connected vehicle will evolve in four stages through 2030. This will provide unprecedented innovation potentials for automotive and technology CEOs, CTOs and CIOs, and lead to the resurgence of the automobile as the ultimate mobile device that leads to new experiences and smart mobility.

**Impacts**

- The telematics stage of the connected-vehicle evolution — mainly safety and security-centric functions — has been completed at the innovation and differentiation levels, which now shifts the focus of automotive and technology CEOs, CTOs and CIOs to leveraging data insights and establishing connectivity across entire vehicle programs.

- Device-to-vehicle and application integration-centered efforts are mostly mature, which will lead automotive and technology CEOs, CTOs and CIOs to shift from general mobile applications to specific customer- and mobility-focused functions.

- Connected vehicles are turning users into connected drivers and consumers who are seeking to converge their digital lifestyle needs with their content and device ecosystems (including the automobile), leading to opportunities for CEOs, CTOs and CIOs in the automotive, services and technology industries.

- The realization of connected vehicles and smart mobility will create innovative, cross-industry IoT opportunities for businesses, governments, societies and consumers, and lead to the rebirth of the automobile, with new values, purposes and participants.

**Recommendations**

CEOs, CIOs and CTOs in connected-automobile-related industries and sectors:

- Understand the partnership options and trade-offs for implementing technology leaders' ecosystems, which include giving them access to some vehicle and customer behavioral data.
Prepare your organizations and partners for real-time, connected-product and connected-customer insights that lead to consistent and integrated digital content and services offerings.

Prepare for a radically expanded definition of the automotive industry as the evolution of the Internet of cars and smart mobility define the concept of industry convergence.

Expand your horizons with a "no-limits" attitude.

Analysis

The connected vehicle is the foundation for fundamental opportunities and disruptions in the automotive industry and many other vertical industries. Connected vehicles will continue to generate new product and service innovations, create new companies, enable new value propositions and business models, and introduce the new era of smart mobility (see "Maverick Research: How Technology Is Ending the Automotive Industry's Century-Old Business Model").

To leverage these new opportunities and to prepare for potential disruptions, it is paramount for leaders of automobile-related organizations to understand the progression of the connected vehicle and its four core evolutionary stages. While these stages overlap in their progression, each of them is characterized by varying progression timelines, focus areas, maturity levels and future innovation potentials (see Figure 1). The four-stage connected vehicle evolution will occur in mature and emerging markets for passenger vehicles. All of the stages also have implications for commercial vehicles, although the third stage is less relevant in that segment.
Gartner first introduced the concept of the connected-vehicle evolution in 2009 (see "Vehicle ICT Evolution: From the Connected Car to the Connected Driver").

The continued progression of the connected vehicle also shows the broadening implications it will have on industries, governments, businesses and markets. Furthermore, the connected-vehicle evolution — and the subsequent transformation of the automotive industry — also epitomizes critical emerging technology topics such as the Internet of Things (IoT), smart machines, operational technologies, smart cities, home automation and digital business. Here, we describe the key impacts of the connected vehicle evolution and provide recommendations for business and technology leaders in the automotive, connected-vehicle, consumer electronics, Internet and services companies, as well as the IT, financial services and government sectors (see Figure 2).
Impacts and Recommendations

The telematics stage of the connected-vehicle evolution — mainly safety and security-centric functions — has been completed at the innovation and differentiation levels, which now shifts the focus of automotive and technology CEOs, CTOs and CIOs to leveraging data insights and establishing connectivity across entire vehicle programs.

**Timeline:** 2000 through 2010.

**Focus:** Telematics represented the first stage of the connected-vehicle evolution, characterized by a strong functional purpose. During this stage, efforts were focused mainly on enabling specific safety- and security-related offerings targeted predominantly at vehicle attributes (such as automated airbag notification to emergency services, user-activated roadside assistance requests and remote diagnostic capabilities).
Maturity: Telematics functions are now offered in many vehicle models in mature automotive markets, and are being developed increasingly for emerging markets. The required technologies are well understood and are decreasing in costs. For example, cellular networks — a requirement — are becoming more ubiquitous. The continued and broader market adoption of telematics offerings will be determined by government support and initiatives, such as the EU’s eCall mandate, which aims to ensure automated assistance to motorists involved in a collision anywhere in the EU by the beginning of 2018.

Innovation Potential: Because telematics represents a mature function of connected vehicles, the innovation potential of underlying technologies is low, except for cost reduction and overall performance improvements. The innovation potential is, instead, shifting toward the use of vehicle data analysis to improve product, marketing and process performance such as:

- Identifying underlying electromechanical system design issues, and providing those insights to the engineering department to address.
- Understanding users’ usage patterns for vehicle functions to determine potential areas that are too complex or limited in use.
- Analyzing overall vehicle usage for the purpose of offering real-time offerings, including maintenance services and usage-based insurance policies.

Recommendations:

- Continue to expand the availability of telematics offerings, and improve their functional value, but don’t pursue efforts with the goal of achieving differentiation from them.
- Analyze vehicle-specific data for insights that lead to improved process optimization in engineering, warranty management, servicing, etc.

Device-to-vehicle and application integration-centered efforts are mostly mature, which will lead automotive and technology CEOs, CTOs and CIOs to shift from general mobile applications to specific customer- and mobility-focused functions.


Focus: The second stage of the connected-vehicle evolution centers primarily on the integration of mobile devices and cloud-based applications into the automobile. Most of these efforts continue to be infotainment-focused by providing driving-specific information (e.g., location-based services, such as navigation) or entertainment-related features (such as in-vehicle Internet radio). During the past three years, especially, automotive companies and technology providers intensified efforts targeting mobile application providers to offer their apps for in-vehicle platforms. The results were often mixed, and many developers cited the lower volume of automobiles, compared to other mobile device platforms, as an obstacle in embracing connected vehicles. The introduction of MirrorLink, Apple CarPlay and Google’s Android Auto has made it easier for automotive companies to integrate existing general mobile applications, but has also introduced potential risks in giving up
— at least some — control over the in-vehicle experience to these technology megaecosystem providers.

**Maturity:** Device-to-vehicle integration solutions are rather mature at this point, and cloud-to-vehicle integration offerings are becoming more common. The general understanding of mobile applications also is maturing quickly, especially for general applications and content offerings. A relatively immature area represents new service offerings specifically targeted at vehicle, brand and customer. Therefore, Gartner predicts that during 2016, most automakers' connected-vehicle content priorities will have shifted from general mobile applications to such vehicle- and customer-specific services.

**Innovation Potential:** General mobile application areas enabled via device and cloud-to-vehicle integration solutions are mostly mature at this point and represent an overall low innovation potential. Instead, more innovation opportunities will come from the development of customer, brand and product-specific applications aimed at maximizing the customer experience during the ownership phase. The goal is to tie customers closer to the connected-vehicle offerings that lead to higher overall satisfaction and differentiation. Examples include a potential application that automatically schedules a service appointment in the owner's calendar when the vehicle detects a service need, or an application that leverages an automaker's own traffic data that is collected from its customers' vehicles in real time via the use of embedded sensors.

Due to increasing geographical coverage of high-bandwidth cellular networks, the reliance on smartphones for accessing mobile applications will decrease in the future. More-attractive pricing models by carriers, and added customer convenience benefits of an embedded solution that can directly connect to the cloud, will result in a growing availability and market adoption of such embedded connected-vehicle offerings in the future.

An area with higher innovation and differentiation potential during this stage of the connected-vehicle evolution continues to be user interface improvements. In particular, hardware and software innovations targeted at creating superior user experiences for accessing, creating and sharing of digital content in the vehicle have the potential for innovations. This will include the usage of haptics, natural language processing and artificial intelligence-enabled technologies that will give users more reliable and targeted options of consuming relevant content in the vehicle, without jeopardizing safety and distraction-relation objectives. Gartner predicts that during 2016, most automakers' connected-vehicle content priorities will have shifted from general mobile applications to vehicle- and customer-specific services (see "Predicts 2015: Connected-Vehicle and Mobility Innovations Inspire New Digital Business Opportunities").

**Recommendations:**

- Redefine your connected-vehicle application content and platform strategy, but define your needs and limits when adopting third-party application ecosystems. Limit the sharing of vehicle-related information with major ecosystem providers to those data categories that don't represent a competitive differentiator or that can be collected via mobile devices anyway (such as basic location information).
Respect customer data privacy and trust requirements, and always declare the use of collected data for the purpose of enhancing users’ experiences or benefiting the larger community. For example, consumers willing to collect traffic information on a regular basis could receive a discount on the vehicle’s registration tax.

Connected vehicles are turning users into connected drivers and consumers who are seeking to converge their digital lifestyle needs with their content and device ecosystems (including the automobile), leading to opportunities for CEOs, CTOs and CIOs in the automotive, services and technology industries.

**Timeline:** 2012 through 2025.

**Focus:** The third stage of the connected-vehicle evolution focuses on embracing the automobile as a critical element in users’ digital lifestyles. Connected drivers are ultimately connected customers and consumers who increasingly have a desire for consuming, creating and sharing digital content in all situations — including when being mobile in an automobile. This convergence means that consumers want to be able to communicate with friends and family members, remain productive to their workplace and to be entertained with the content that they also access outside of the automobile. Users will also expect an automotive connectivity experience that is similar to other device experiences they are increasingly accustomed to, such as remote, over-the-air, software updates and content/services upgrades. Due to the ongoing, overall manifestation of consumers’ digital lifestyles, combined with new advancements in connected-vehicle offerings, this third stage will take a longer time to mature than the previous two. This stage also will be characterized by new companies entering the automotive industry, such as technology companies that already are part of consumers’ digital lifestyles. For example, in 2011, Gartner predicted that by 2016, at least one megatechnology company will have announced plans to develop its own automobile offering (see "Predicts 2012: Technology Innovation Starts a New Automotive Era").

**Maturity:** Digital lifestyle convergence is a relatively new area for the automotive industry and beyond. Most progress will be achieved in the next 10 years as the mobile Internet and the connected vehicle become interdependent on each other.

**Innovation Potential:** The digital lifestyle convergence phase of the connected-vehicle evolution provides significant innovation opportunities for the automotive, as well as many other industries — especially technology industries. For example, the need for converging digital lifestyle content and services requires cloud computing, data/device/user management, data security, application and services providers, and much more. The opportunity also extends into developing new service offerings and innovative business models that span across multiple device categories, including the automobile. For example, carriers recently introduced the ability for consumers to add a vehicle to their existing data plans for a flat monthly fee. These types of cross-device offerings will have to be defined differently for various consumer segments and geographic markets. They will also need to be evolved in conjunction with partners of a broader connected-device ecosystem and include digital business objectives to become attractive to end users.

For automotive companies, this digital lifestyle convergence also means that all of their customer interactions — and those of their partners — will have to become increasingly digital. For example,
presale, sale and postsale interactions, including service department or dealer-initiated communications, must provide contextual insights based on real-time and historic user and transaction data, and be fitted into an overall digital experience. Digital lifestyle convergence also offers new revenue opportunities for the automotive industry and technology companies. For example, Gartner predicts that by 2017, 25% of all automakers will start to monetize mobile commerce transactions conducted from their connected-vehicle offerings (see "Predicts 2014: Automotive Companies’ Technology Leadership Will Determine the Industry’s Future"). One particular area that represents such an opportunity is car-to-home integration. A 2014 Gartner study showed that 18% of U.S. vehicle owners already were interested in getting features that allow them to control their home automation from within the car (e.g., automatically setting home alarms, thermostats, etc.).

**Recommendations:**

- Think beyond the automobile when creating connected-vehicle experiences and partner with nonautomotive companies to achieve integration of existing digital lifestyle content and services. At the same time, become the master of extending other content and ecosystem experiences into the automobile.

- Prepare your organization and partners to take advantage of real-time, connected-product and connected-customer insights that lead to consistent and integrated digital content and services offerings. Adjust your technology and partner investments to capture real-time customer and product insights that can be shared across your internal and external stakeholders.

The realization of connected vehicles and smart mobility will create innovative, cross-industry IoT opportunities for businesses, governments, societies and consumers, and lead to the rebirth of the automobile, with new values, purposes and participants.

**Timeline:** 2014 through 2030.

**Focus:** The final stage of the connected-vehicle evolution centers on the broader implications of the connected vehicle across many industries, public sectors and entire societies. As defined by Gartner in 2012, connected vehicles and innovative technologies, such as self-driving vehicles, will lead to the new era of smart mobility that redefine transportation and automotive ownership models, and challenge established business models. For example, on-demand, driverless cars that are paid for by the trip will compete with traditional ownership-centric approaches.

Automobiles connected to the Internet, the infrastructure and themselves establish the Internet of cars, which represents the first fundamental realization of the IoT vision and create new monetization opportunities for automotive and nonautomotive businesses. Governments will use these truly mobile devices to capture traffic information, pollution data and people movements to define smart cities. Societies will be able to offer mobility to everyone, regardless of age or mental and physical capabilities. At the same time, accidents and their negative health and economic consequences will be minimized as connected vehicles monitor the state of all passengers at any time, and drive them autonomously to the closest hospital in case of an emergency. These advancements, however, will also lead to a shift in employment because certain job categories will
no longer be needed, such as individual transportation services, vehicle collision repair providers, etc.

The progression of intelligent vehicles and smart mobility will lead to the renaissance of the automobile, and have an impact similar to the invention of the automobile's effect on horse carriages.

**Maturity:** The Internet of cars has just recently begun to emerge in the form of demonstrations and testing in real-life applications. Due to the need for widespread technology adoption, integration of other connectivity scenarios (i.e., smart cities) and interdisciplinary opportunities, smart mobility will achieve a meaningful level of maturity by 2030.

**Innovation Potential:** The innovation potential of the final stage of the connected vehicle evolution is very high and pervasive. Innovations span from vehicle-to-vehicle and vehicle-to-infrastructure communication technologies, to data analytics, smart cities and digital business models such as on-demand mobility solutions, and will impact many industries including the financial services, retail and commerce, manufacturing, and services verticals. This will result in significant examples of industry convergence — the concept of diminishing industry boundaries and cross-industry value experiences (see "Industry Convergence — The Digital Industrial Revolution").

During the next five years, self-aware vehicles will emerge that are increasingly able to autonomously sense, interpret, decide, take action and communicate with other automobiles, infrastructures, businesses, people and organizations. As this self-awareness matures into the next decade, vehicles will become progressively smarter and autonomous. This will lead to the most fundamental change in transportation, mobility and society — the self-driving vehicle, which will be the first pervasive, personal robots that most consumers will experience in their lifetimes.

Individual innovation areas include hardware, software and data communications efforts such as vehicle and infrastructure sensors, positioning capabilities, imaging and guidance technologies, machine learning, artificial intelligence and deep-learning capabilities.

Early market indicators regarding smart mobility features are also encouraging. A 2014 Gartner study focused on U.S. vehicle owners indicated:

- 22% of the respondents were interested in vehicle-to-infrastructure communication technologies to optimize traffic flow, automate road tolling, etc.
- 19% of the respondents were interested in vehicle-to-vehicle communication technologies centered on informing drivers about road conditions, cars running red lights, etc.

**Recommendations:**

- Prepare for a radically expanded definition of the automotive industry as the evolution of the Internet of cars and smart mobility exemplify the concept of industry convergence — a growth strategy focused on innovative, cross-industry value experiences that will create new possibilities for organizations to pursue business opportunities outside industry sectors in which they previously conducted the majority of their business.
- Embrace automobiles as mobile sensors and connected devices that create new digital ecosystems and business models that span various industries. These business models can leverage fluid product, service and revenue aspects to create new offerings that are the result of engaging in new segments and/or collaboration with other companies.

- Expand your horizon with a "no-limits" attitude. Automakers, which by definition satisfy consumers' mobility needs, should have invented the smartphone with its value proposition focused on providing mobile communications.

Gartner Recommended Reading

Some documents may not be available as part of your current Gartner subscription.

"Maverick* Research: Crashing Industries and Our Societal Beliefs — The Real Implications of the Autonomous Vehicle"

"Predicts 2015: Connected-Vehicle and Mobility Innovations Inspire New Digital Business Opportunities"

"Forecast Analysis: Internet of Things, Endpoints and Associated Services, Worldwide, 2014 Update"

"Hype Cycle for Vehicle-Centric Information and Communication Technology (Vehicle ICT), 2014"

"Automakers’ Adoption of Android Auto Meets Industry and Consumer Needs, but at a Price"

"Industry Convergence — The Digital Industrial Revolution"

Evidence

In a representative study conducted and analyzed in 1Q14, Gartner surveyed 2,185 adults in the U.S. and Germany who owned or leased an automobile. The online survey was used to analyze consumer demand for vehicle information and communication technology (ICT) features, as well as attitudes regarding connected-vehicle options.