



Why Your Car Will Soon Become Your Friend

The advent of voice assistants built on natural language processing, artificial intelligence and telematics will unleash an assortment of voice-activated features and functionality that will make driving more enjoyable, efficient and effective.

Executive Summary

It is a human tendency to assign personalities to our cars. With increasing adoption of natural language processing (NLP) assistants and voice bots, a natural and meaningful progression for automakers is enabling our cars to speak and respond, expanding the relationship that humans have with their vehicles.

Given that the long-term roadmap for vehicles involves levels of autonomous driving, an enhanced customer interaction experience is a

necessary step.¹ Voice assistants are at the heart of an entirely new set of consumer expectations and automakers are fiercely competing to meet those expectations and reinvent the driving experience. Mercedes,² BMW,³ Ford⁴ and other automakers are driving this change, which goes beyond typical vehicle benchmarks of engine power, handling and styling. Consumers increasingly are looking for availability of conveniences like the connectivity they have at their home or in their smartphones to expand their in-vehicle experience.

Importantly, in-vehicle usage differs from how this technology is applied in smartphones and connected home devices. Frequently made available features extend beyond music to focus on managing calls as well as navigation and providing geo-locational intelligence. Even more intriguing are applications such as pre-ordering food before arriving at a quick service restaurant or searching for a product and then asking to navigate to the nearest location where it is available.

While the interaction of voice assistants and drivers is arguably an underserved market today, numerous technology companies, to name a few – Amazon, Apple, Cerence, Google, Sound-Hound – have jumped into the fray to develop voice platforms and collaborate with original equipment manufacturers (OEMs) to bring these new experiences to drivers.

This white paper discusses a potential implementation roadmap for delivering voice capabilities within a vehicle. We cover the key challenges as well as offer a technology and high-

level architecture view for creating a comprehensive way forward that auto manufacturers should consider.

Voice: The next marker on the road to a more satisfying driving experience

The voice assistant roadmap can be viewed across three distinct stages, depending on where the OEM is in its implementation journey (see Figure 1).

Core offerings

An NLP assistant can potentially improve the user experience of the current vehicle without too many dependencies. This starts with implementing the following features:

- I Functionality on the go.** Modern vehicles come with a bewildering number of features and options. In fact, most car owners are unaware about how they can extract the best of their vehicles' capabilities. For example, only 55% of drivers were familiar with tire-pressure

The voice journey

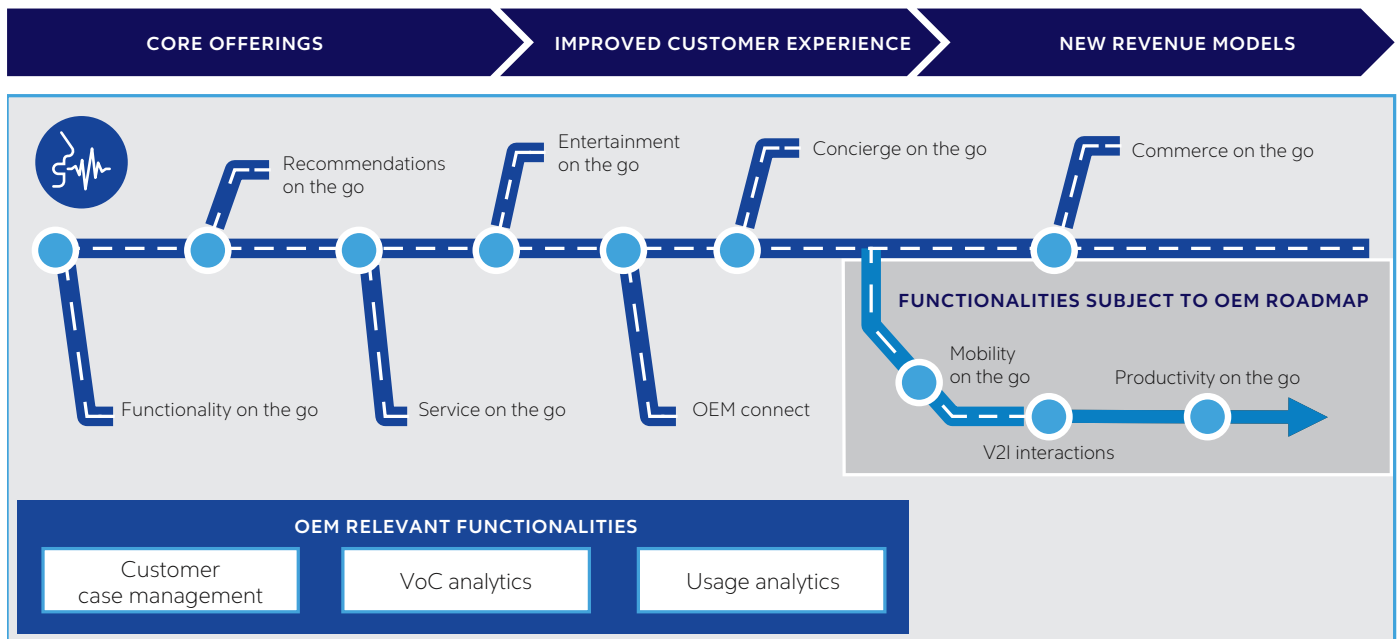


Figure 1

monitoring systems that the U.S. government has mandated since 2007.⁵ OEMs try to manage this through handover activities where the salesperson explains the features of the car; however, there is only so much that the customer can absorb in this setting. Vehicle functionality operator triggers on a voice command and advises the user on the car's functionalities. Vehicle user guide is another capability where the voice assistant can guide the customer to use specific features by highlighting the necessary buttons or switches by lighting them up. Based on the usage patterns of the vehicle, data models identify commonly used features so that the user guide can proactively let the customer know how to execute an operation and get the best out of the car.

- I Navigation and recommendations/Points of interest (POI) on the go.** Current navigation capability can be augmented by NLP's ability to handle queries and voice guidance. Context-rich location-based recommendations –restaurants, malls, tourist attractions, etc. – can be handled well by NLP rather than how OEMs handle this today by maintaining large, costly call centers.
- I Service on the go.** Assistants can be used to locate and book service on the fly. They can also help in the case of an accident or to get roadside assistance. In advanced cases, telematics data can be used to identify vehicle issues when they haven't yet attained critical proportions. Vehicle assistants can be used to advise the vehicle owner on the next steps to avoid unexpected catastrophic failures and significant repair expense.

Enhanced customer experience

With the evolution of vehicles, users will look for more entertainment options within the vehicle. These options can also be an extended source of revenue for the OEM:

- I Entertainment on the go.** Vehicle assistants can deliver entertainment services such as Pandora and Spotify, and search songs and play them accordingly – or change channels. They can even retrieve information from the internet based on a question such as "What are the scores for the ongoing New York Mets game?" Taking entertainment offerings to the next level by providing recommendations based on the customer's preferences, for example, will delight car owners looking for satisfactory experiences while driving.
- I OEM connect.** OEMs do not have a mode of direct interaction with their customers and vice versa. Typical information flow is through the service center to the OEM's field service team. Through voice assistants, the OEM can receive feedback on the customer's sales and ownership experience, which can then be analyzed to drive future products and services. Issue resolution can also be carried out. Warranty issues, recalls, insurance, credit and other queries can also be resolved through OEM connect. Based on driver behavior and usage analysis, OEMs can offer customized usage/service plans to the customer directly.

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I Concierge on the go. Vehicle concierge can span a large number of highly useful functionalities. Concierge combined with a vehicle wallet can execute numerous useful functions while on the go. These include ordering food or tickets. The concierge can take requests and share useful information to passengers, acting as a guide while they are traveling.

New revenue models

With vehicle sales numbers stagnating, OEMs are exploring other sources of revenue. The overall revenue pool from car data monetization at a global scale could reach \$450 billion to \$750 billion by 2030.⁶ NLP assistants are a ready channel that can provide leverage through the following:

I Commerce on the go. In commerce on the go, vehicle assistants receive telematics data and analyze it on the back end. Potential issues and service needs are then flagged to the customer. A vehicle assistant can also direct the customer to the nearest authorized service

center as well as book appointments. For DIY customers, the assistant can be integrated with the OEM's e-commerce parts and accessories site and voice which part needs to be replaced on the vehicle's head-up display (HUD). Such an integrated environment could also enable purchases as well as delivery to the customer's address. The assistant can also guide the customer and fulfill the purchase of accessories contextualized to the owner's vehicle.

I Mobility on the go. Numerous OEMs as well as mobility service providers are exploring how to offer services such as ride booking, cab hailing and ridesharing services for end customers as well as businesses. We envisage the vehicle assistant as a fulcrum that enables ordering and usage of such OEM in-house and third-party urban mobility services. Based on vehicle usage patterns that the vehicle assistant identifies as well as patterns that the OEM mobile app identifies, OEMs would be able to also offer suitable mobility services/programs that take care of the customer's urban mobility needs.



- I Vehicle to infrastructure (V2I):** We expect the future mobility ecosystem to have large-scale adoption of similar assistants across the roadside infrastructure – at toll booths, parking centers, convenience centers, EV charging stations, service stations, etc. Interaction through secure protocols between in-vehicle and external assistants can facilitate and encourage such interactions, manage payments and keep the user updated through voice, text notifications and scheduled reports. The OEM would manage all the vehicle assistant’s activities through appropriate monitoring and exception management tools.
- I Productivity on the go.** Future vehicle development roadmaps are invested heavily with autonomous capabilities. In light of this, in-vehicle productivity capabilities (apart from entertainment) will become a key requirement. We envisage assistants playing a key role here as well, such as reading and responding to emails while on the move, creating “to-do” lists, setting alerts and taking actions on a corporate dashboard/to-do list. Integrations with corporate tools housed on enterprise systems as well as with infotainment services would add value and further functionality to the in-vehicle assistant. To encourage this, OEMs should consider opening up the code for third parties to work on such capabilities as well.

Furthermore, while the roadmap for virtual assistants encompasses the complete customer buying and ownership experience, the customer also feels highly engaged with the OEM.

Additional functionalities include sharing feedback with the OEM, outreach from the OEM on contextualized offers/deals and 24x7 support for driver engagement. Apart from monetizing feature availability and opening up a new revenue stream, OEMs also obtain a data-rich contextual understanding of customers at a micro and macro level. Highly contextual data gleaned from voice assistant interactions can yield crucial insights for OEMs to understand customer concerns and delights as well as vehicle and functionality usage.

Challenges to be surmounted

As potential use cases and exciting possibilities of an in-vehicle assistant multiply, so do the challenges that must be overcome when implementing intelligent voice systems. They range from infrastructure capabilities, platform and technology capabilities, to adapting to ever-changing customer requirements and competition.

- I Designing and understanding conversations.** Building a robust conversation model is of paramount importance, though it isn’t easy. Not only does every person speak differently, but also there are various regional variations, dialects and range of words used to consider. Given aural distractions both inside and outside of the car, focusing on the right voice is critical. The supporting hardware’s placement must be designed to maximize the throw of voice commands. Also, leveraging machine learning on prior interactions and user preferences

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(while masking privately identifiable information) enables the voice assistant to learn more about the user and obtain the context of the user's communications, thus deepening the relationship.

I Keeping the interaction simple. The voice assistant should augment the driver's multi-tasking capabilities without distracting them. This is a fine balance to achieve and should be the mantra of all such use case implementations,. Complicated and multi-step flows and unnecessary alerts to the driver while in motion should be avoided at all costs. Simplicity in conversation model should be deemed essential.

I Wading through the connectivity considerations. Connectivity to the internet via the telematics' modem remains a challenge in certain areas of the world that suffer from bandwidth constraints. OEMs need to segregate and optimize code while planning for redundancies so that loss of connectivity is handled in critical use cases (e.g., those that are safety related) so they can still function while others can pick up from the point where connectivity is lost.

I Security and personal data compliance.

The exponential use of Internet of Things (IoT) devices has unleashed a torrent of personally identifiable information (PII) that if not shielded is accessible to hijacking – including our email, our shopping history and even our news preferences. The emerging range of activities that voice assistants can perform is creating a gateway for hackers interested in this broad spectrum of information.

Voice fingerprinting might be necessary in cases where only the driver needs to be in charge of the conversations. OEMs need to ensure that they're not neglecting security in favor of usability and cost. It is always recommended to make security the foremost priority in the product design stage itself. Virtual private clouds should be tapped to store the necessary data with GDPR and CCPA privacy policies in place. We suggest using two-factor authentication (2FA) methods for users – such as a biometric on steering plus voice fingerprinting, or immobilizer frequency matching.^{7,8} Additionally, filtering out ambient noise and other noise frequencies using filters and event timeouts will prevent unintended commands from being executed. Carefully design



use cases to ensure that personal data collected is not published to co-passengers' devices. On the other hand, it is also the developer's responsibility to use standard transport layer security (TLS) and authentication protocols.⁹

A 360-degree smart-car architecture

The basic hardware infrastructure to support a telematics-enabled vehicle with a smart head unit with speakers and mic is required. This enables streaming data from the vehicle to the cloud through a data streaming application and IoT gateway. Hot storage is typically used for computing immediate decisions for trigger events according to the business functions based on use cases. The output would be processed and rendered in the head unit/mobile app/wearables or through voice assistant to the users.

In the case of customer queries through a contact center, some of the information adhering to PII data compliance can help contact center executives further assist customers. Additionally, OEMs need the ability to perform analytics, derive business insights and monetize the data collected and stored over a period of time. Cold storage can help in storing such data and can integrate with business intelligence and analytics platforms for further assessment via dashboards or analytical models.

To go to market, we recommend leveraging a cloud service provider, streaming service provider, NLP services and serverless architecture, given the multiple options. Specific customizations can be performed as per the needs of use cases.

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Extended Cognizant Car 360 architecture

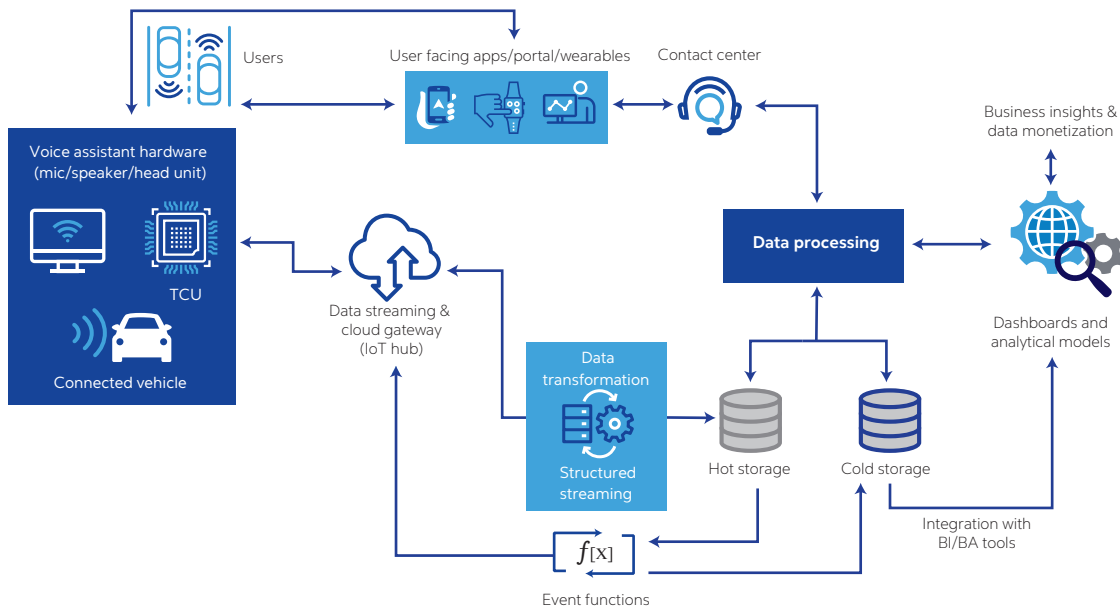


Figure 2

Looking Ahead

Vehicle assistants are poised to become a key aspect of the in-vehicle and service experience for customers going forward. As mentioned above, numerous OEMs have already started out on this journey.

Given the typical human element of applying personas to our cars, voice assistants and the growing need to experience customization can add

tremendously to the owner's experience. Younger generations are growing up with NLP assistants as a result of the proliferation of smartphones and smart speakers in their homes. Over time, vehicle assistants will be customized for different members of a family and interact with them individually, which will dramatically transform the human-vehicle relationship.



Endnotes

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Every day the world shifts more toward new digital media and interactive experiences. With rapidly evolving technologies, changing consumer preferences and oftentimes competing channels, many organizations struggle with how to transform internally to meet the challenges of this new, always connected digital world. Cognizant Digital Strategy Consulting enables organizations to create engaging and consistent digital experiences across every touch point, providing new opportunities for growth.

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