

Cerence Car Life

White Paper

At Cerence, we want people to fall in love with their cars. As with any long-term relationship, this begins with a deep understanding and appreciation for what’s possible in a car, from the first time someone gets behind the wheel and throughout the life of the vehicle. Our new Car Life product suite will help create a tighter bond between people and their cars, the same way they become attached to other hard-to-live-without electronics such as smartphones. This benefits OEMs by transforming customers into clients, delivering knowledge and insight that enable them to better support their drivers and establish brand loyalty.

Market Dynamics

As cars have become more complex, it has become increasingly difficult for drivers to navigate the many features, notifications, warning lights, and buttons. In principle, these are all meant to make the driver’s life easier and safer, but apparently cars often miss a very important element...someone who can showcase all the various features in an easy, fun and a non-annoying way. Printed manuals fall short of that. Video tutorials don’t scale well. Dealer training can be spotty. What’s needed is a new approach. Enter Cerence.

A recent YouGov Survey among drivers in Germany and the UK sought to better understand use cases of an in-car voice assistant. Participants were provided with several options for an assistance, including help with car diagnostics, understanding new car features, managing conversations with family and friends, finding the best route, searching entertainment and more. Among all the options, 42 percent of the participants noted a preference for “Help me deal with car diagnostics, report issues and understand new car features.” In addition to this, the Cerence UX team conducted a study in January 2020 where participants were video recorded during their drives, live tracked via an OBD device. They were sent proactive updates based on their location and other driving information on a smartphone attached to their windshield. These proactive updates were delivered in the form of a short tone and pop-up notification. Participants rated their satisfaction with these updates, reflected on the overall experience with them in daily video logs, and provided detailed feedback during exit interviews following data collection. Analysis of user ratings and participant feedback in exit interviews shows that users (1) like daily briefs, including traffic and road condition updates and non-urgent car maintenance information in the form of voice and text on screen, (2) want only context-relevant updates during the drive, (3) welcome urgent car maintenance notifications in the form of proactive voice updates, and (4) find Feature Teaching useful only for features they have never or very rarely used before. Results also suggest that except

for urgent, safety-related updates, users (1) want the option to dismiss a proactive notification, and (2) would like the delivery to be as less intrusive as possible, which by user choice, are GUI notifications and a soft tone. Hearing the proactive update should still be offered to the user as an option, as several users preferred listening to voice updates to avoid distracted driving.

In addition to these driver desires, OEMs look to Infotainment and advanced driver assistant services (ADAS) to play an essential role toward helping people evaluate and buy a new vehicle. Another recent study [a], this one from Cox Automotive, reveals that today’s car buyers intend to gather comprehensive knowledge about a potential vehicle using on-line sources. At the dealership, they look forward to spending more time learning about the vehicle and its features firsthand. As a result, dealers must have a strategy to help buyers get to “yes” and make the absolute most of a visit to the dealership.

Furthermore, another study [b] reveals that the current vehicle buying experience is less than ideal for the buyer, where only one in three consumers are “satisfied” with the current dealership model. Dealers tend to agree, with 89 percent of the dealers surveyed believing they must find new innovative ways to sell and service to be viable for the long road ahead. This extends too from the vehicle buying experience to the complete ownership of the car as dealers now must look to services such as home maintenance, service pick-up and drop-off, and introduction to the available unused features that are increasingly expected by modern day drivers [b,c].

It’s clear that researching, buying and owning a car is very different today than in the past. Consumer expectations have changed, dealer priorities have evolved, and new technology is now available. As result, to address the complexities and the opportunities of the car ownership life cycle and true to our mission of a safer, more enjoyable experiences for everyone, we are pleased to introduce Cerence Car Life.

Cerence Car Life

Introducing Cerence Car Life

Cerence Car Life is a suite of AI-powered knowledge solutions that provides drivers with the best answers and information – all of which can be tailored to each car, its configuration, and the continuously learned preferences of the driver – via a companion application, voice output from the automotive assistant, and imagery displayed on the car’s infotainment system. This product suite is available within the Cerence Drive portfolio and can integrate and operate with other global voice assistants, including Google, Amazon, Baidu, Alibaba, Yandex, and others.

This innovative and intelligent SaaS product suite will support drivers with:

- A full introduction to a new car, its intelligent assistant, and its key features when entering it for the first time (or even before entering it) via a companion smartphone or tablet application.
- Contextual, smart car knowledge to help drivers understand the car’s status, including warning lights and error messages and how to deal with them based on up-to-date information from the car’s sensors. This includes support for multi-modal interactions. The driver can use both voice and gesture to point at warning lights and ask questions.
- A voice-powered smart car manual that can alleviate the need for bulky, printed car manuals. It gives users the ability to ask the car about its features, potential issues, warnings lights, and more, all using their voice.
- Car learning modules that a driver can listen to while driving to learn about the car. It can also schedule dealer appointments for service and updates based on alerts and diagnostics generated by the car.
- Proactive sharing of information to ensure drivers are aware of the features hidden deep within the complicated menus of the car, including for new features provided through over-the-air updates.

Car Life Product Offerings

Car Life has three distinct product offerings: Dealer Assist, Car Knowledge and Car Health. The following table summarizes the product offering.

Dealer Assist

Dealer Assist empowers dealers and OEMs with tools and services that can redefine a vehicle buying experience by explaining the potential of the car more effortlessly. Currently, there are no means to track which questions a user might ask across different dealership networks. Having a centralized solution, OEMs can learn about the homogeneous behavior of their potential buyers and improve the dealership experience over time.

Like the other offerings of Cerence, OEMs control the ultimate user experience. For instance, OEMs can provide a list of “cool features” when creating the solution. During the test drive, dealers can start Car Life in a demo mode with a simple command: “Hey Car Life, start in demo mode.” Then, Car Life proactively explains and advertises the features of the car to the potential buyer.

OEM and Dealer Benefits	End User Benefits
Supplement the salesperson with a virtual product specialist	Empower consumers with a product specialist that: - listens to their needs - interacts with them to explain the vehicle(s) in a low-pressure environment
Unified and seamless button free user experience across all dealership network	Allow the vehicle buying experience to be - Interactive and seamless - personalized and easy based on their preferences and schedule
Input: list of marketing specification of car models (model specifications, detail features per car model, cool features per car), car manuals and FAQs	
Output: Q&A to explain the car model selected by potential buyers	
Personalized feature explanation based on the user’s needs	

Car Knowledge

A car is a complex machine with hundreds of thousands of parts, tens of thousands of software parameters, and many technical configurations. There's no conceivable way an owner can know all the features and there is also no foolproof way to assist them in diagnosing a problem in the vehicle. To address an issue, drivers either perform an online search or refer to the owner's manual, but this can be limited and time consuming.

Car Knowledge helps drivers understand their vehicle by answering questions related to the inworking and functions of the car, such as "How do I turn on the seat heating?" We provide a voice-enabled question and answer (Q&A) system as a user guide to the car. An important aspect of Car Knowledge is that the answers may differ from car model and its configuration to the next. To address a range of needs, Car Knowledge has four modules to choose from:

Owner's Manual Q&A – This module allows users to ask voice-enabled questions of various car features. The underlying source of information is owner's manual content. User can ask questions such as "how do I connect my smartphone", "where can I find my spare tires", "how do I change engine oil", etc.

Frequently Asked Questions Module – The FAQ module covers most questions that are not in the owner's manual or based on OEMs experience. We use the question and answer list provided by OEMs. We can also mine OEM-specific questions from the Web.

Contextual Module – This module aims to answer contextual questions such as "what is my current tire pressure?" To understand the current car context, we seek a gateway to OEM's backend server that stores

sensor information such as tire pressure, engine temperature, oil level, etc. We use the sensor values to provide the correct answer to the user for the current car context.

Proactive Module – This module is designed proactively inform customers about available features, such as "Do you want me to teach you how to change winter tires?" The proactive module is one of the core components of the Car Life product suite where we can intelligently learn the right time for educating drivers on a new feature based on in-car context. The proactive module utilizes the capabilities of the Cerence AI and reasoning framework. We consider user studies to answer three important questions of proactivity: 1) when is the right time for proactive notification? 2) what is the feature that can be taught at this time? 3) How this feature needs to be taught.

OEM and Dealer Benefits	End User Benefits
Credible information from OEM about their car, which contains owner's manual, Frequently Asked Questions	Help customers to understand their car by e.g. answering questions dedicated to working and functioning of their car
Scalable solution in multiple languages	Replace the need for online search
Automatic update/add new or updated car manual	Answers are credible depending on the model of the car user has
Input: Car manuals, FAQ list	Allow multi-channel access (smartphone app, etc.) to ask questions and learn more about the car
Output: Q&A on the source to know the car better	
Proactively teaches new features based on context	
Integration with OEM's other channels such as call centers, and chatbots for answering car related questions	

Car Health

According to a study [d], a new car's routine maintenance and repairs costs an average of \$1,186 each year. This includes oil change, windshield wiper replacement, new battery, brake pad replacement, tire rotation or replacement, and more. There is evidence [d] to show that 70% of existing customers will consider switching to a brand with benefits such as automatic service scheduling, at-home pick up/drop-off for vehicle maintenance, etc.

To simplify vehicle maintenance, our Car Health offering allows consumers to learn about car health proactively and get alerts well in advance of trouble. It automates the process for scheduling service using an in-car voice assistant or via the OEM companion app. This product builds on the top of the contextual module from Car Knowledge. Many times, if there is an issue in the car, one should not visit the service center. The solution can be fetched from the owner's manual. In such cases, this product alerts drivers about a current issue in the car and then intelligently suggests how to fix this. If the answer is not in the owner's manual, the product provides suggestions to visit the dealership.

OEM and Dealer Benefits	End User Benefits
Allow third-party integration of OEM partner network, such as service center, car rental, etc.	Remove friction in vehicle maintenance experience
Scalable solution in multiple languages	Automatic service scheduling either <ul style="list-style-type: none"> - Initiated by consumers - Proactively initiated by the vehicle - At-home pick-up/drop-off
Input: access to OEM server that stores current state of car (engine temp, tire pressure, etc.)	Proactive notification based on the current context (e.g. your current time pressure is low, do you want me to schedule a service appointment?)
Output: voice-enabled health notification, coupled with the possibility to book service scheduling	Learn user preferences over time

Car Life Features

The section details all features of the Car Life product suite. Each product contains one or more features. Based on the requirements of an OEM, a feature can be included in the product offering. In total, Car Life has 11 features. In the table below, each feature is described along with a sample use case. We also list the product name in which a particular feature is part of.

Feature ID	Feature	Description	Products	Sample User-case
CL1	Predefined feature advertising	Car Life proactively explains predefined “wow” features by an OEM to all potential buyers in a seamless dialog	Dealer Assist	<p>System: Hello Carrie. I’m here to help you explore new features available in this vehicle. Can I start by showing you the ones I think you’d find most interesting?</p> <p>User: sure.</p> <p>System: Using just your voice, you can reserve and pay for parking without leaving your car. Also, I can book table at whatever restaurant you want.</p> <p>User: Sounds interesting.</p> <p>System: Also, this <car model> offers a new feature to help you find whatever information you need. Now you can directly ask questions found in your car manual by speaking to the assistant. Try something like, “How do I connect my phone to Bluetooth?”</p>
CL2.1	Single Q&A on FAQs	Q&A on the FAQ list provided by the OEMs (approx. 1000 FAQs). User-initiated questions and full support on paraphrasing	Dealer Assist, Car Knowledge	<p>User: What is ACC?</p> <p>System: You can use the ACC button on the steering wheel to set a desired distance to the vehicle ahead of you. The car will automatically accelerate or brake to keep this distance.</p> <p>User: Thank you.</p>
CL2.2	Single Q&A on car manual	Q&A on the content of the owner’s manual. User-initiated questions and full support on paraphrasing	Dealer Assist, Car Knowledge	<p>User: How do I connect my phone to the car?</p> <p>System: You can connect to your mobile device using the several ways shown on the screen. You only need to pair your phone once by either Bluetooth or Apple Car Play and your device will automatically connect to the vehicle every time.</p> <p>User: Thank you.</p>
CL2.3	Single Q&A on marketing specs	User initiated Q&A to check if feature is present in the car model, content from marketing feature-list	Dealer Assist	<p>User: What is the top speed of this car?</p> <p>System: The top speed of this car is 220 kmph.</p>
CL3	Multi-step Q&A (co-reference resolution)	Full dialog support across product features	Dealer Assist, Car Knowledge	<p>System: This car has automatic cruise control.</p> <p>User: How do I use it?</p> <p>System: Press the “ACC” button on the steering wheel to set your desired distance.</p>

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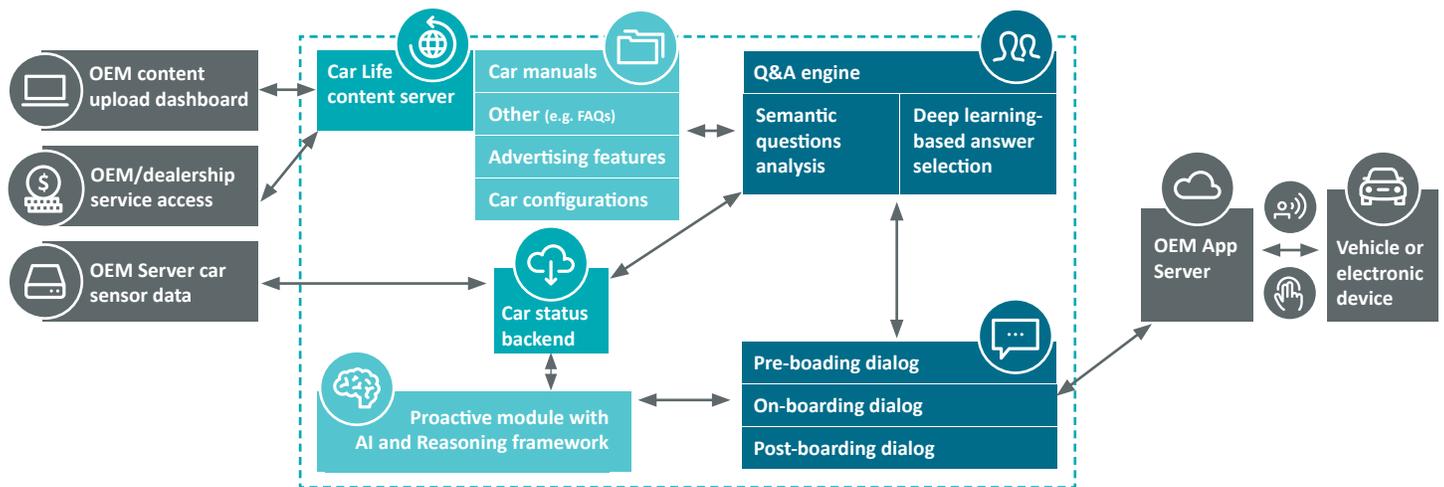
Feature ID	Feature	Description	Products	Sample User-case
CL4	User preference learning and model search	Integration into OEM website to collect a few additional questions. Save preferences for personalization, user identity using an UID	Dealer Assist	<p>System: Are you buying this car for your family?</p> <p>User: Yes.</p> <p>System: Do you also have children?</p> <p>User: Yes, I have a month-old child.</p> <p>System: Thank you. Your preference is saved. We look forward to welcoming you during the test drive.</p>
CL5	Personalized feature advertising	Car Life proactively explains custom "wow" features specific to user persona and lifestyle	Dealer Assist	<p>System: Hello Carrie. I'm here to help you explore new features available in this vehicle. Can I start by showing you the ones I think you'd find most interesting?</p> <p>User: Sure.</p> <p>System: Did you know when you turn off and exit the car; I can check if a child is still present. If so, I will send an automatic alert to your mobile phone.</p> <p>User: That is great.</p>
CL6	Single Q&A on contextual status	Q&A to check contextual status based on specific sensor information provided by an OEM; user initiated questions	Car Knowledge	<p>User: What is my engine temperature?</p> <p>System: The current engine temperature is 196-degree Celsius. This is within the optimum range.</p>
CL7	Feature Teacher	Proactively teach essential features to all the new car owners. Information source is car manual and FAQs	Dealer Assist, Car Knowledge	<p>System: Hello Lauren. Looks like you haven't used all your new features yet. Do you want me to give you a daily update of features you might be interested in?</p> <p>User: Okay</p> <p>System: To check your tire pressure, just say something like "what's the current tire pressure."</p> <p>User: Cool</p>
CL8	Feature Teacher-Personalization	Proactively teach unused features to the respective car owners; Information source is car manual, FAQs and personal usage history	Car Knowledge	<p>System: Hello Maria. I see that you are enjoying the drive. Just so you know, you can put the car on ACC and relax while the traffic is low.</p> <p>User: Umm, what is ACC?</p> <p>System: You can use the ACC button on the steering wheel to set a desired distance to the vehicle ahead of you. The car will automatically accelerate or brake to keep this distance.</p> <p>User: That's great! Can you turn it on for me?</p> <p>System: Sure, let me do it.</p>
CL9	Proactive Maintenance Notification	Proactively alert users based on car context if there is a maintenance issue in the car based on contextual status and diagnostics. Schedule service appointment	Car Health	<p>System: Hello Claudia. Looks like it's time to change your tires to winter tires. Shall I schedule an appointment for you?</p> <p>User: Sure. When is the earliest availability?</p> <p>System: The earliest availability is on Tuesday near your office.</p>
CL10	OEM specific Multi-channel Access for Car Life	Integrate Car Life features via OEM companion app	All products	-----
CL11.1	Content upload	OEMs can upload content in semi-automatic way via UI	All products	-----
CL11.2	Content upload-automatic	OEMs can seamlessly upload content in fully automatically via UI	All products	-----

Car Life Solution Overview

Now we describe the technical details of our products. The section describes the solution overview of Car Life which includes its architecture and required input sources. Considering Car Life relies on authentic inputs provided by OEMs such as the owner’s manual, FAQ list, etc., we describe the different input sources needed for the product.

Car Life- Architecture

Car Life has three products and one comprehensive architecture. Based on the underlying product and the features chosen by the OEM, the architecture is customized for the needs of the OEMs. Hence, each feature is an abstract layer on top of the architecture. However, the core architecture and its components remain the same. Cerence customized the architecture per feature basis. OEM can opt in and pay for features. The underlying architecture is implicitly part of each feature offering.



Holistic Architecture Description

App Server: The Car Life application server interacts with OEM access channels such as an in-car voice assistant or companion app.

Preboarding/Postboarding/Onboarding Dialog: This module is the dialog module for three different stages of Car Life.

Q&A Engine: This is the core question and answer technology of Cerence. It accepts the owner’s manuals, FAQs, and other knowledge sources as input.

Proactive Module: The proactive module is a standard module for each stage of the car life to proactively explain certain features. It maintains the list of dynamic features taught to the user and learned elements. The learned features differ at different stages. We have Cerence-powered AI and a reasoning framework in it.

Car Status Backend Gateway: This is the contextual module that Cerence implemented for accessing OEM sensor information. This module is necessary for post boarding (for voice-enabled proactive notifications and service scheduling).

Embedded Components: The majority of Car Life offering is cloud only. However the following components can be also offered as embedded in addition to the cloud offering:

- The FAQ and the Owner’s Manual modules of Car Knowledge can be offered as an embedded solution.
- The proactive module has one optional in-car embedded module which learns the car context over time. This module is important to decide if there is the correct time for proactivity.

Cloud Components: All the other components sit in the Cerence cloud.

Input sources: To build the customized Car Life product for an OEM, we seek several input sources which are a prerequisite for the development depending on the features chosen by an OEM. There are six different input sources as described below:

- **Car manuals and FAQs:** OEM provides the owner’s manual for several car configurations and a list of FAQ questions. In case an OEM does not have an FAQ list, Cerence can help to create a list of 500-1000 FAQs.
- **Access to car status back-end:** This is the OEM sensor information which stores information such as tire pressure, engine temperature, etc.
- **Cool Feature List:** At preboarding, for each car model, if an OEM wants to promote a few cool features, this can be provided to Cerence. Once a potential buyer visits the dealership and goes for a test drive, Car Life will prioritize these features to be taught or explained to the buyer proactively. This is the first step towards a proactive feature explanation at the dealership.
- **Interface to OEM Website at test drive booking stage:** For enhanced proactivity feature explanation at the dealership during the test drive, Cerence needs some additional information about the user. While she books a test drive, we request an OEM to ask a few further questions based on our UX studies (e.g., are you buying a car for the family, do you have a child, etc.). It allows Car Life to prioritize the features during the dealership visit (e.g., Hey User! This car has a wow feature “child left behind mechanism; would you like to know more about it?”)
- **Marketing Specs:** All the features which are not present in the owner’s manual such as available interior color, top speed, acceleration, etc.
- **Interface to OEM service network:** For booking the service appointment, we seek access to the service network and drivers’ calendar. A simple API call will suffice.

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Implementing Car Life

To implement Car Life in an OEM ecosystem and enabling via an in-car voice assistant, the following components will be required.

Cerence Drive Framework	Cerence Cloud Services	Professional Services	Embedded Integration Details
<ul style="list-style-type: none">Contains the embedded module that handles Wake-up Words (WuW)Explicit requests and implicit requests for embedded controls for in-car access	<ul style="list-style-type: none">Contains all the Car Life modules to handle requests and process them to fetch the right contentSpecific ASR/NLU customizationHandles implicit references and advanced scenarios requiring complex ASR/NLU processing	<ul style="list-style-type: none">Provides custom-specific dialogs and plug-ins for Cerence Drive dialog updates (cloud) and over-the-air (OTA) updates (embedded)	<ul style="list-style-type: none">Cerence provides speech expertise and intelligent routing of requestsCerence or OEM provide embedded client integrationOEM controls the interface with the voice assistant

Additional Features

Access via OEM companion App

Many features of the Car Life solution can also be accessed via an OEM companion app. Cerence will work with the OEM for integration. In case an OEM does not have a companion app, Cerence can implement one for accessing the Car Life features.

Access via OEM Chatbot and Call Center

- The FAQ module of the Car Life offers unique functionality to answer generic questions related to the car and its functions. Many times, users call OEM call centers to ask about issues in the car. As Car Life contains Q&A functionality on the content of the owner's manual and FAQs, many of such questions can be answered automatically and do not need human intervention.
- Cerence can provide an intelligent solution to reduce a lot of traffic to OEM call centers. Questions will first go to Cerence powered virtual assistant and Car Life will seek the answer in the knowledge base. Only when an answer is not there, the call will be forwarded to the human agent.

Self-Service Capabilities

The key aspect of our offering is to provide OEMs a seamless way to update and upload newer content. Thanks to the customization, each car has a different configuration and several frequent updates are needed in the owner's manual and FAQs. For the same, we develop a self-service capability for providing a seamless upload mechanism to update and alter the content. In the case of the owner's manual, we provide an upload feature on a Web UI. OEMs can upload newer versions of the owner's manual and our automatic information extraction tool will fetch the newer content to update the underlying knowledge base. Within a few days, changes can be seen in the production environment where questions are answered based on newer content. Similarly, OEMs can upload FAQs, and alter the answers using a Web UI. A screenshot of such a web UI is provided.

Car Manual Upload

Choose a Car Manual zip file

Browse... No file selected.

Enter a Version (7 digits)

Enter Version

Upload Manual

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