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White paper | June 2021 | Remote Vehicle Access from Bosch Engineering

# Universal remote access solution for measurement, diagnostics, and flashing of vehicle software

The increasing complexity of new vehicle functions is leading to a sharp increase in the scope of testing in development and engineering processes. Remote systems that can be used during test drives to access the vehicle from the outside via a data link for the purpose of recording measurement data, running diagnostics, and flashing software updates offer considerable time- and cost-saving potential. With remote vehicle access (RVA), Bosch Engineering has developed a powerful, user-friendly solution that is universally deployable for all aspects of the vehicle and domains and that moreover meets strict safety and security requirements.

## Introduction

The challenges in automotive engineering are growing continuously. To be in a good position to respond to tomorrow's mobility requirements, technological development must be accelerated, particularly in areas of strategic opportunity, like powertrain electrification and automated driving. The complexity resulting from this means that the scope of testing carried out as part of the development and engineering process also continues to grow. At the same time, there are increasing time and cost pressures that weigh on manufacturers, suppliers, and service providers. This leads to, among other things, more test content **needing to be completed in a shorter period of time with fewer prototype vehicles** by, for example, having the testing teams perform parallel measurements and calibrations for **different domains in the same test vehicle**.

In the light of this, the question of efficient use of testing resources is gaining importance. Remote systems, which enable a wireless, long-distance data link between a PC in the vehicle and a computer in the test engineer's office, have the potential to **save a lot of time** in the development process. The great flexibility offered by remote access and the opportunity to work on problems together means that the speed of response of contractual partners (customers as well as suppliers) increases significantly. Measurements carried out in the field previously meant the test engineer had to be present personally to analyze them, which entailed considerable organizational effort and took up a lot of time. Thanks to RVA, however, engineers can quickly and efficiently perform a pre-analysis via a remote connection and remedy problems by supplying new data that can be flashed remotely.

While this does not represent a complete substitute for the usual presence of test engineers on site, it does lead to a more efficient way of working. **The experiences of Bosch Engineering have shown that the direct feedback that can be provided on the test result significantly shortens iteration loops** in the calibration process – normally, those iterations would prolong the time required for testing and could even necessitate additional test dates alongside all the setup effort that that entails.

## One system for multiple applications

With remote vehicle access (RVA), Bosch Engineering offers a digital service that has been specifically designed for vehicle testing applications. The system is incorporated in Bosch's cloud-based online platform Calponia (Fig. 1). The platform's purpose is to simplify and automate complex development and engineering processes. To do so, it provides essential basic functions and an open application area that can be used to integrate services like RVA. Its user-friendly interface makes it easy for test engineers to configure RVA and get it up and running on their own. To use it, they simply log into Calponia and the service from their PC in their office. The desktop content of the vehicle PC is then sent to the office computer via the connectivity gateway and a 4G data connection. This gives the test engineers remote access to the application parameters of the respective vehicle function, enabling them to change the parameters as needed and directly view the effects on the measurement data. In addition, file synchronization provides the option to synchronize the data between the vehicle PC and the cloud platform. Configurable upload and download folders are synchronized in the background for this purpose.

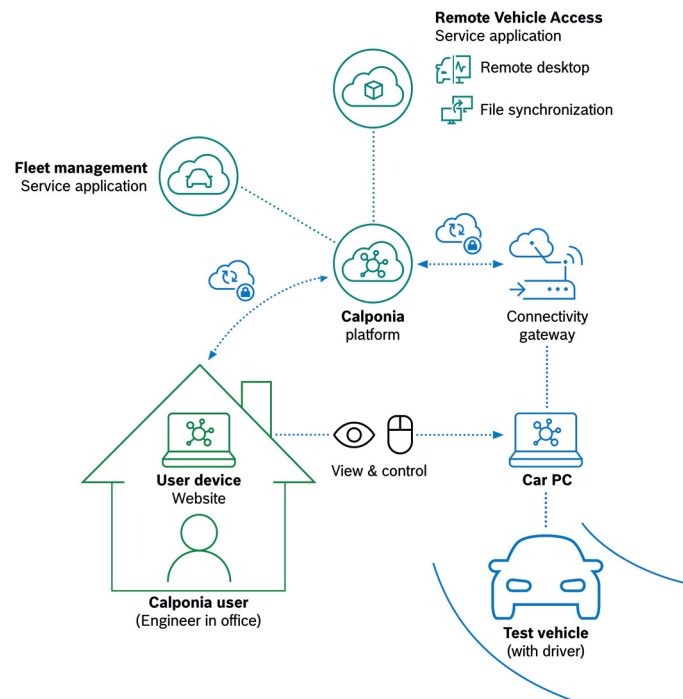


Fig. 1: Diagram of remote vehicle access using the cloud-based platform Calponia

The benefits of the straightforward handling offered by RVA can be seen, for example, in the endurance tests performed in driver assistance development. Up to now, when problems arose with the measuring system, the test driver would have to meet the calibration engineer with the vehicle on site at the workshop. With RVA, the calibration engineer can connect from anywhere via the measuring computer directly to the vehicle's testing equipment and resolve the issues regardless of where the vehicle is located.

Remote service solutions like RVA are especially valuable for complex diagnostics and calibration tasks that require the expertise from various experts in different areas. An example of such an application scenario is the adjustment of a new electric drive in which the chassis design must also be taken into consideration and adapted. The experts from the various domains can log themselves directly into the vehicle PC via a remote connection and can work together in a virtual team on the optimization of the vehicle setup regardless of where they are located.

Another example of use for RVA is in ABS/ESP design optimization performed within the scope of calibration of a new vehicle model. For testing under ideal conditions, vehicle tests are often conducted a long way away from the development facility. Winter testing, for instance, takes place on frozen lakes in Lapland in the Arctic Circle. The calibration engineers carry out these sophisticated test drives themselves so they can correctly assess the aspects of the test results relating to the vehicle's driving dynamics. Finding the optimum in calibration furthermore requires a deep understanding of the ABS control algorithm. That is why the test engineers work closely with software specialists situated at the company site. Without a remote connection, the software engineers would gain access to the measurement data – which they analyze and discuss with the calibration engineer – only after the test drives have been completed. Thanks to the data link, however, they can assist the calibration engineer online already during the test drive and provide immediate feedback on current measurements or propose other specific driving maneuvers in order to carry out more detailed analyses. This leads to a considerable increase in efficiency in the calibration process.

### High safety and security standards

Important criteria when selecting or configuring a remote system are universal applicability and a holistic safety and security concept that takes into consideration all safety- and security-critical aspects. In the case of RVA, the data connection between the cloud-based platform Calponia and the vehicle is established over the LTE network. Once access has been configured, the only piece of additional hardware needed is a gateway offering Linux-based connectivity that engineers connect to the vehicle PC. This concept provides a great deal of flexibility in terms

of interfaces to the vehicle PC as well as the data formats that can be transferred, thus ensuring easy installation in the vehicle and the ability to use the system universally for different vehicle tests.

The safety and security concept of RVA is built on multiple pillars. The data is protected by encryption based on the latest technology standards, both during transmission from the vehicle and while stored in the cloud. The elements relevant to security are continuously adapted on the cloud side as well as on the connectivity gateway and therefore always represent the current state of the art. The entire concept is validated with so-called penetration tests, which simulate cyberattacks and test the effectiveness of the protective mechanisms. Safety plays a major role when vehicle functions are modified from outside the vehicle. An example is when a calibration engineer modifies the parameters of the powertrain or assistance systems during an ongoing road test in order to make comparisons. Apart from the fact that these changes may only be made in close coordination with the test driver in the vehicle anyway, the test driver will receive a notification on the display of the vehicle PC that must be confirmed before remote access is granted. In addition, the remote connection to the backend automatically goes offline if no input takes place within five minutes.

### Professional end-to-end system solution

RVA is a professional end-to-end system solution for enabling a full-access remote connection to the vehicle that not only allows data to be read but also to be flashed too. The system is part of a secure ecosystem, can be easily installed and operated, and can be deployed with a high degree of flexibility for all vehicle tests, regardless of the test content. For access to the RVA digital service, Bosch Engineering offers two packages that differ in terms of whether the customer wants a complete solution that includes a communication gateway or whether they want to use their own hardware (Fig. 2).

	Base Service Solution	All-In-One System Solution
<b>Hardware: Device Kit</b>		
Connectivity device incl. cable harness	*	✓
SIM-card incl. data plan	**	✓
<b>Info: Supported devices</b>		
– BEG Connectivity Gateway	✓	✓
– CarMediaLab Flea4	✓	
– Bosch Rexroth RCU4	✓	
<b>Service</b>		
Self service device configuration	✓	✓
Plug and play (easy installation based on documentation)	✓	✓
<b>Cloud Service</b>		
Remote access	✓	✓
Automatic file & data synchronization	✓	✓
Security encryption	✓	✓
Vehicle & equipment management	✓	✓
1st and 2nd level support	✓	✓

\* Use of existing connectivity device at customer  
\*\* SIM card and data plan is in responsibility of customer

Fig. 2: Overview of the remote vehicle access product packages

Both packages include setup of the services, provisioning of a cloud service, and fast and effective support in case of any issues with the service. If a customer has special requirements relating to the RVA service that go beyond this, Bosch will provide them with custom solutions.

### Summary and outlook

The benefits of remote access – the speedy analysis of measurement data from a distance and the opportunity to immediately examine the effects of variations in parameters – make it a highly efficient tool for road tests in the development chain. It can be assumed that use of remote services will become established in future as a quasi-standard in automotive engineering. With RVA, Bosch Engineering has developed an especially flexible, robust, and economical solution for long-distance data transmission in measurement engineering applications. It incorporates the vast experience that the company has gained in recent years worldwide and in all vehicle domains in the areas of automotive calibration and measurement engineering.

### Are you interested in remote vehicle access?

Please feel free to get in touch with our team to get started. We will be delighted to help you. Find out more about remote vehicle access on our website and stay up to date by subscribing to our newsletter.

[www.calponia.com](http://www.calponia.com)

Bosch Engineering GmbH is a wholly owned subsidiary of Robert Bosch GmbH and is head-quartered in Abstatt, Germany. As a systems development partner to the automotive industry since 1999, the company with its more than 2,800 associates offers development services for powertrains, safety and convenience systems, and electrical and electronic systems – from the original concept to series production. Specialized in electronics and software, it draws on Bosch's proven large-scale series production technology to develop tailored solutions for a wide variety of applications in passenger cars, commercial vehicles, off-highway and recreational vehicles, and in rail applications, ships, and industry. Bosch Engineering GmbH also coordinates all the Bosch Group's motorsports activities.



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