How over-the-air connectivity is transforming the capabilities of modern vehicles

Discover the remote connectivity features that are driving significant change and diversification in the automotive industry, as revealed by a survey of over 100 automotive industry professionals

INSIDE:

- The primary challenges and obstacles of OTA and SOTA implementation
- The key solutions OTA and SOTA offer to automotive practitioners
- What the future holds for OTA and SOTA

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Introduction

Over-the-air (OTA) technology refers to the application of wireless connectivity to remotely upgrade, analyze or maintain systems through remote exchange and installation of data packets. This is not a new concept and, in areas such as the mobile phone industry, it is essential for customer convenience; customers would not expect to be required to go in-store to update mobile phone or application software, for instance. The technology has now reached the automotive industry and vehicle manufacturers are now able to update software and firmware remotely, without the need for their customers to visit a dealership.

Aside from remote updates, automotive manufacturers have found several applications for OTA technology, including telematics and advanced driver assistance systems (ADAS). Consequently, drivers are able to experience greater functionality from smart vehicles than ever before, such as live vehicle information and analytics which feed wirelessly to vehicle displays and maintain ADAS to keep drivers safe through autonomous emergency braking systems.

However, as with many new technologies, the implementation of OTA solutions is not without its challenges. As revealed by an Automotive IQ survey of more than 100 automotive industry professionals, many automotive practitioners have flagged issues in areas such as legacy technologies, security and regulatory compliance as problematic barriers to OTA implementations.

This report takes a deep dive into the applications, benefits and obstacles associated with OTA, with a specific focus on software-over-the-air (SOTA), a subset of the overarching technology. In exploring these topics, this report will consider current and planned use cases, key challenges and opportunities involved with OTA and SOTA implementation.

Contents:

"I think the future demands a more complex "ecosystem" approach where connectivity and OTA updates will have to extend beyond the traditional automotive sector as vehicles interact with electricity grids and road infrastructure for example."

Tony Burton
Strategy and marketing director at Thales

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Key challenges and obstacles

With 68 per cent of survey respondents flagging security concerns as the primary obstacle to OTA and SOTA implementation, it is clear that security concerns will need to be addressed before automotive organizations feel comfortable with a more comprehensive adoption of OTA and SOTA technologies.

"There is clearly a security barrier there, but it's one of those that can and must be overcome," notes Tony Burton, strategy and marketing director at digital and 'deep tech' solution provider Thales. "This is because there is enormous potential for both the automotive industry and the consumer when you consider what's possible when you do have that connectivity in place."

The implementation of OTA updates opens automotive organizations up to a range of security concerns, including tampering, counterfeit parts, information leakage and denial of service attacks, which all present serious issues due to the highly critical nature of some OTA and SOTA features. Burton explains that the previous approach to maintaining vehicle security, which he refers to as a 'citadel' approach and involved locking down entry and exit points to a vehicle's software, is no longer viable. This is because there are simply too many entry and exit points when information is shared through OTA and SOTA. Going forward, he recommends a 'zero trust' approach, whereby every part of a connected system, whether it is a piece of software, a system or a person, starts off without the ability to exchange data. It is only once they have earned that trust, through authentication and certification, that they gain the ability to interact with the vehicle's ecosystem, exchanging data for updates and software maintenance or repair.

"There are many different ways of achieving that sort of trust where people are in the loop, from human biometric features to two factor authentication and pin numbers," remarks Burton. "But from a software and remote connectivity perspective, you need to have designed in those trust mechanisms through techniques such as digital identities, roots of trust, cryptographic key exchanges and code signing and certificates for your software"

Aside from security issues, 42 per cent of survey respondents highlighted legacy technology issues as another significant barrier to the implementation of OTA and SOTA initiatives. According to Tata Communications

global head of connected automotive solutions Saurabh Ohri, the primary issue with legacy technology arises from the compounding addition of new vehicular systems over time. He notes that with original equipment manufacturers (OEMs) adding new systems into vehicles and continuously needing to update these systems, customers will begin to experience many more frequent updates.

"That's where the OEMs really need to rethink how they design the update process, because now you've got 20 to 30 different systems on the vehicle that need to be updated," Ohri explains. "And that's where you really need to think about how and when you're going to do it, because you can end up introducing a lot of complexity putting you in a position where you're updating constantly."

This can represent a significant inconvenience to the customer, detracting from the convenience offered by OTA updates in the first place. Ohri believes that moving forward, OEMs need to rethink and redesign end-to-end OTA and SOTA processes, taking into account all relevant variables, such as update timing, management, user content and whether or not that update is considered critical.

The implementation of OTA and SOTA initiatives will also require OEMs to stay abreast of national and global regulatory restrictions relating to aspects such as vehicle standards and data security. In order to stay on top of regulatory restrictions and maintain compliance OEMs will

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›› Key challenges and obstacles

be required to develop vehicle architectures, compliant monitoring, update and support models and also ensure they have a single customer relationship management system (CRM). This will all be necessary to ensure that all data relating to individual customers and their vehicles is available and accounted for, allowing OEMs to ensure compliance for regulations such as 'right to repair' implemented in the EU in 2002 and the US in 2014, cyber security regulations such as UN ECE WP29 and data regulations such as the GDPR implemented in the EU in 2018.

GDPR necessitates complete control over and accountability for customer data, which becomes much more challenging when dealing with numerous, complex OTA updates and information transfers.

UN ECE WP29 sets out UN Regulations that require measures be implemented across four distinct disciplines that support approval of vehicle cyber security management systems and software update management systems:
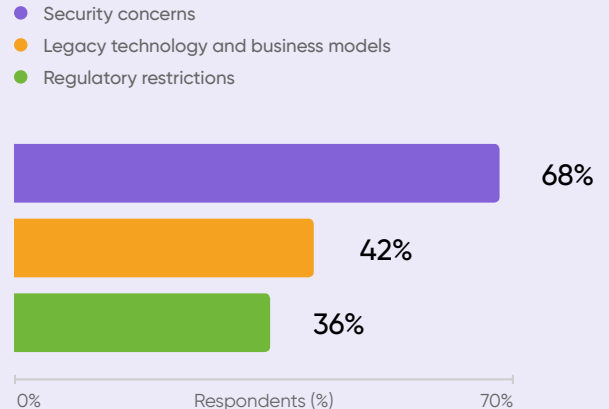
1 Managing vehicle cyber risks

2 Securing vehicles by design to mitigate risks along the value chain

3 Detecting and responding to security incidents across vehicle fleets

4 Providing safe and secure software updates and ensuring vehicle safety is not compromised, introducing a legal basis for so-called OTA updates to on-board vehicle software.

'Right to repair' regulations enforce a similar need for efficient management of customer data, as the regulation requires that technical data and repair instructions should be made available to the independent motor trade, so that customers are not forced to employ the services of a single franchise to handle vehicle repair.

These are three examples of why the implementation of a unified customer, technology and process approach is now mission critical for OEMs to maintain regulatory compliance for OTA and SOTA implementations.

FIGURE 1:

What are the barriers to your business that could impede (further) OTA/SOTA implementation?*

- ● Security concerns
- ● Legacy technology and business models
- ● Regulatory restrictions

68%

42%

36%

0%   Respondents (%)   70%

* Respondent could select more than one option

SOURCE: *'How do you secure global connectivity for critical vehicle data management and OTA/SOTA updates?'* Automotive IQ, 2020

FIGURE 2:

Do you have a security monitoring capability for vehicle connectivity solutions?
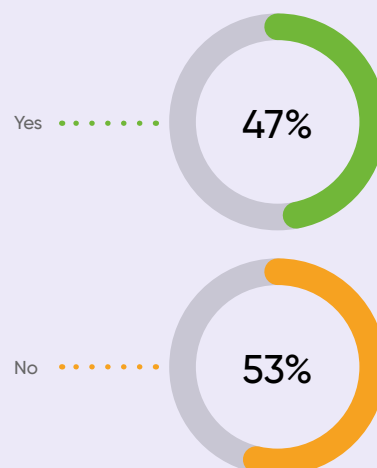
Yes ● ● ● ● ● ● ●   47%

No ● ● ● ● ● ● ●   53%

SOURCE: *'How do you secure global connectivity for critical vehicle data management and OTA/SOTA updates?'* Automotive IQ, 2020

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The solutions offered by OTA and SOTA

Despite the challenges involved, the implementation of OTA and SOTA initiatives can offer significant benefits for OEMs and drivers alike. One benefit that is of particular significance to our surveyed automotive industry professionals is safety, with 60 per cent of respondents flagging this as a primary benefit for OTA and SOTA initiatives. Tata Communications' Ohri notes that there are two types of updates relating to OTA and SOTA, critical and non-critical, and it is those critical updates that can really improve safety for drivers. He points out that there are currently a large number of vehicle recalls out due to software, and it is the ability to update those critical systems where OTA and SOTA are really going to be able to improve safety.

"There is a famous case from Tesla back in 2018, where it was able to improve the braking distance of their Model 3 via an OTA update," remarks Ohri.

Other benefits of the application of OTA and SOTA highlighted by survey respondents include faster feature updates (52 per cent), which offer new levels of convenience for drivers, and enhanced ability to collect data (49 per cent), which can assist with improved marketing and ability to comply with data regulations.

In terms of current use cases in the automotive industry, telematics and advanced driver assistance systems (ADAS) lead the way, with current use for OTA and SOTA cited by 39 and 36 per cent for telematics and 37 and 31 per cent for ADAS, both respectively. However, it appears that the implementation of ADAS represents a more long-term goal for OEMs, with planned use for OTA and SOTA at 48 and 42 per cent, respectively, compared to 38 and 30 per cent for telematics.

Telematics is essentially the process of transmitting information over long distances and is used to facilitate remote management of vehicles. The ability to have remote, OTA transmission of all relevant vehicle data, including data relating to aspects such as location or repair diagnostics, is hugely beneficial for organizations that manage fleets or even individual vehicles.

"I think the use of telematics over the coming years will be enormous," remarks Thales' Burton. "The ability to communicate over the air with those systems is essential to the safe functioning of connected vehicles."

According to Burton, one of the key benefits of the application of OTA and SOTA for telematics involves the

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collection of data. He notes that if you have a whole fleet of vehicles transmitting to you, then you will end up sitting on an incredibly large and valuable lake of data that, over time, an organization can ingest and make sense of, applying it to improve the quality of the product or service on offer.

Aside from offering real-time diagnostics regarding current, required vehicle maintenance, telematics can also assist with predictive maintenance, explains Burton. For example, if telematics are providing information that a vehicle being driven in a certain way will have a certain system fail after 50,000 miles, while another will fail after 100,000 miles that is immediately actionable information that can be fed back into the system to reduce the frequency of vehicle breakdown through preventative maintenance.

ADAS refers to the growing number of systems and features designed to improve safety and convenience for drivers and pedestrians alike. Given the increasing complexity and prevalence of such systems, which include features such as automatic parking and cruise
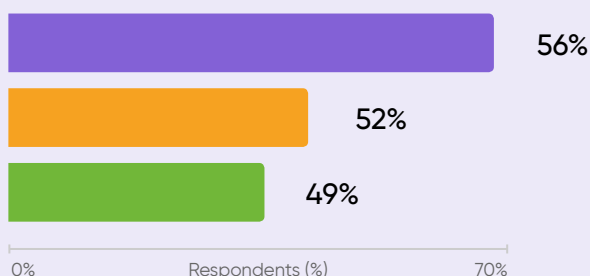
control, the continuous monitoring, management and updating of ADAS' could represent a significant challenge. This is where the application of OTA and SOTA connectivity can make things much easier for OEMs to monitor and upgrade ADAS over time.

FIGURE 3:

What are your main considerations for using OTA/SOTA?*

- Safety
- Faster feature updates
- Collecting data

56%
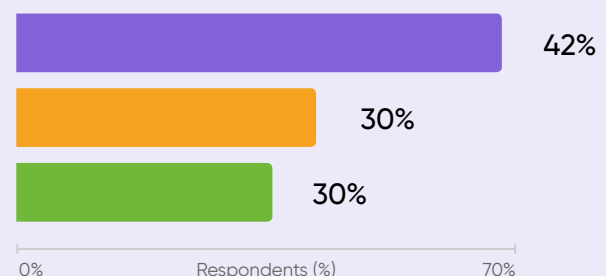
52%

49%

0%   Respondents (%)   70%

* Respondent could select more than one option

SOURCE: 'How do you secure global connectivity for critical vehicle data management and OTA/SOTA updates?' Automotive IQ, 2020

FIGURE 4:

For which systems or services is your business planning to extend SOTA connectivity for updates to the vehicle's systems in the next 12–36 months?*

- Advanced driver assistance systems
- Telematics
- Entertainment system

42%

30%

30%

0%   Respondents (%)   70%

* Respondent could select more than one option

SOURCE: 'How do you secure global connectivity for critical vehicle data management and OTA/SOTA updates?' Automotive IQ, 2020

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The future of OTA and SOTA

Despite the many advancements that have been made in the automotive industry with regard to OTA and SOTA, the field is still relatively young and looks set to develop further in the coming years, as OEMs begin to take full advantage of the convenience offered by connected vehicles and work to further develop the features they offer. For example, compliance with automotive security standards will demand monitoring and update of critical systems to prevent potentially harmful breaches and SOTA will help avoid costly recalls or regular trips to a service department. This is something that will only become more difficult as more and more features, systems and individuals become connected to a vehicle's ecosystem. Thales' Burton believes that this is an area where we will see increasing development over the next few years:

It is also likely that we will see increasing ability for OEMs to track the status of connected vehicles with the aim of identifying ideal times to update or upgrade software. The industry is likely to see the continued development of connected vehicles' abilities to provide a connectivity 'health check' that informs OEMs of the status of a vehicle, whether it is ready to receive an update and even help with prediction of ideal update windows, to minimize inconvenience to the driver.

"We think that's becoming more and more important," remarks Tata Communications' Ohri. "Because when you want to update all of these features on the vehicle, you're bombarding the vehicle with software updates all the time, so it's important to find the right window for that to happen."

"I think there is quite a lot to be done in terms of the vehicle and security architectures that will have to be in place to support the exploitation of over the air software updates and all of the connectivity that will be needed to support that," he notes. "I think the future will require an even more complex approach as the vehicles interact in an ecosystem that is going to extend well beyond the automotive sector. Resilience will become the watchword as we recognise that in a hyper-connected society we cannot control every aspect that will interact with the vehicles."
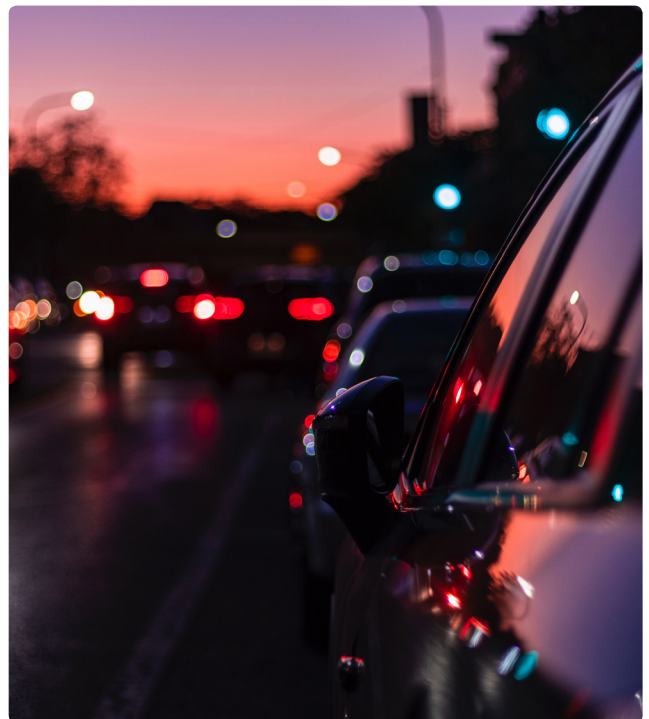
Conclusion

OTA and SOTA connectivity helps to facilitate the implementation and management of numerous vehicle features and services, including ADAS, which enhances driver safety and telematics enabling OEMs to stay informed about the status of vehicles or fleets. Given that the development of new features for applications such as vehicle safety and convenience is not likely to slow anytime soon, the application of OTA and SOTA connectivity to help manage these features will become mission critical and universal across all manufacturers. As drivers become more aware of what vehicles can offer, with regard to convenience and safety when employing OTA and SOTA connectivity, manufacturers who fail to take steps to develop capability in this area may find themselves falling behind their competitors.

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