

Empowering automotive innovation

Seizing the connected car opportunity with Microsoft

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Executive Summary

Digital transformation is fundamentally reshaping the automotive industry, thanks to changing customer expectations and the rise of the cloud, advanced analytics, the Internet of Things (IoT), and other breakthrough technologies. Cars are increasingly becoming connected, creating new opportunities for automotive manufacturers (OEMs), Tier one suppliers, and ecosystem partners. A connected car solution is the starting point for seizing these opportunities.

Delivering an end-to-end connected car solution requires investment in digital technologies and partnerships. Microsoft is the only technology partner that brings together a globally scalable and secure cloud infrastructure, strong data analytics capabilities, productivity tools, and a partner ecosystem into an agile platform that provides total flexibility and control.

[The Microsoft Connected Vehicle Platform](#), built on Microsoft's cloud, leverages the best of Microsoft technology, which prioritizes global scale, security, and flexibility at a fundamental level. With global availability supported by 38 datacenters around the world, including China, the platform gives OEMs a secure and reliable cloud. And automakers can customize and innovate on the platform in whatever manner they choose, including hardware, software, and services from third parties and other vendors. Microsoft provides the supportive foundation and extensive capabilities that enable OEMs and help them deliver differentiated, finished solutions.

The Microsoft Connected Vehicle Platform consists of a comprehensive set of Microsoft services and products that span the physical (car) and digital (cloud), with a focus on addressing commonly required use cases. These include **telematics and predictive services, productivity and digital life, connected advanced driver assistance systems (ADAS), advanced navigation, and customer insights and engagement**. Within these use cases, the number of applicable scenarios is nearly limitless.

Tier one suppliers and systems integrators, as well as digital ecosystem services providers, are critical in taking connected vehicle solutions to market. They provide key last-mile differentiation by customizing and innovating on the Microsoft platform. No matter where an OEM or supplier is in the process, Microsoft's Connected Vehicle Platform offers a way to accelerate, scale, and support ongoing innovation. It provides a world-class technology foundation, enabling automakers to focus on developing differentiated, brand-specific experiences.

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Digital transformation & the connected car

Digital transformation is redefining what cars can do and what people expect from them. The foundation for this shift is that vehicles are becoming more connected. By 2020, 90% of new cars will have connectivity capabilities.¹ This connected car environment creates a path to safer, higher quality products, expands revenue opportunities, and is a catalyst for other advances, such as optimized ride-sharing, autonomous driving, and V2X (vehicle-to-vehicle, vehicle-to-infrastructure, vehicle-to-pedestrian, vehicle-to-anything) technologies.

Connected cars, which are vehicles equipped with the necessary hardware and software to connect to the cloud, generate new and varied types of data that OEMs can use to derive actionable insight. Data from sensors on the vehicle and its surrounding environment has the potential to transform how OEMs and Tier one suppliers plan, engineer, build, deploy, market, and maintain product quality and safety. It also creates opportunities to foster deeper customer relationships and meet growing customer expectations.

In addition to transforming products and customer relationships, the connected car is the foundation for **new digital business models and revenue streams** worth billions (or trillions) of dollars. Add in the value of driver data, which is expected to become a highly-valued asset, and the potential expands even further.

Considerations for pursuing a connected car partnership

A connected car solution approach involves building capabilities in-house or partnering. The primary advantage of an in-house approach is that the solution is fully controlled, ensuring it aligns to specific requirements and objectives. However, an in-house-only approach can be limiting. Cloud connectivity and datacenter operations, for example, are costly and challenging to maintain at scale, due to regulatory differences, data privacy laws, and similar factors that vary globally. And firms may struggle to address related market disruptions that fall outside their core competencies.

By pursuing a partnership approach, OEMs and suppliers can rely on a technology partner's expertise, freeing up resources for building differentiated products and experiences. Partnering also creates more options for customization, opens the door to new services and features, and enables firms to be nimble and adapt faster to the ever-changing technological landscape.

Choosing the right technology platform partner requires evaluation of the partner's capabilities, strategy, and market position. The right partner will support your unique objectives and approach, and won't limit your choices with a static solution. They will have a cloud capable of collecting, storing, and analyzing data in a way that is secure and globally scalable, and that ensures data is always under your control. The right

¹ Telefónica, Connected Car Industry Report, 2014.

partner will have a pedigree, vision and long-term commitment in artificial intelligence that will enable new intelligent services and user experiences. And of course, the right partner won't compete with you for market share or brand loyalty.

Microsoft's approach

Accelerating innovation with the Microsoft Connected Vehicle Platform

Microsoft believes that a flexible platform is the best way to support an auto firm's connected car strategy. That is why we are delivering the Microsoft Connected Vehicle Platform, a cloud-based foundation that OEMs, Tier one suppliers, and 3rd party services providers can use to deploy unique connected car solutions. This platform approach accelerates innovation, as it enables firms to focus on developing differentiated customer experiences, instead of on building infrastructure that does nothing to enhance an automotive brand.

Our platform brings together the best of Microsoft technology to create a back-end foundation. This includes a global cloud, productivity tools and artificial intelligence capabilities that serve as the basis for innovative solutions. The platform can also integrate with on-premises infrastructure, allowing data from connected vehicles to drive insights and action throughout a business.

Across technologies, core attributes of our approach include:

Flexibility and control. Through our history in the automotive space, we've learned that flexibility and control are essential. With that in mind, the platform is not an in-car operating system or a finished product—it is a living, agile platform that supports and enables automakers' unique offerings. Using our platform as a starting point, auto firms can work with systems integrators to build custom solutions tailored to their goals.

Openness. OEMs are free to use hardware and software from their preferred providers, integrate with preexisting solutions, and add in specialized third-party capabilities in areas like in-vehicle security. As an example, let's say an OEM wants to use an existing navigation solution, or wants to develop one with another technology vendor—the platform supports both of those options. In other words, the platform gives firms the freedom to use whatever services, components, and capabilities are best for them.

Support for ongoing technology evolution. The platform is designed to incorporate the latest technologies as they develop, ensuring that connected car solutions stay up-to-date. For example, as 5G communications and V2X technologies become widespread, the platform will support that evolution. This also means OEMs and suppliers can provide new services and capabilities beyond the initial sale of the vehicle, extending customer engagement throughout the lifetime of the car.

Consistency. Today, an OEM may have multiple solutions in market that are differentiated by region, brands, and model years, leading to mounting operational costs and complexity as these solutions are maintained. Microsoft's platform can address this by integrating with and unifying existing solutions, simplifying operations, and enabling new capabilities and scenarios.

A single, global connected vehicle platform

The [Renault-Nissan Alliance](#) sells one in ten cars worldwide. Microsoft is working with Renault-Nissan to pioneer the next generation of connected car services.

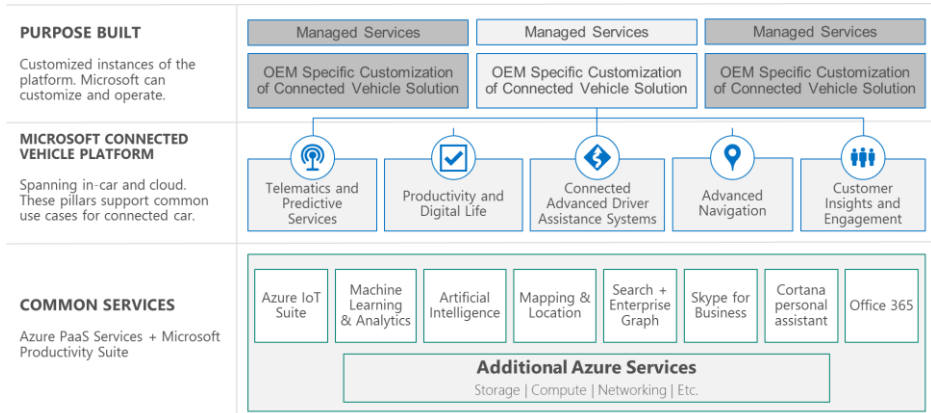
"Partnering with Microsoft allows us to accelerate the development of the associated key technologies needed to enable scenarios our customers want and build all-new ones they haven't even imagined,"

– Ogi Redzic, Renault-Nissan Alliance senior vice-president, Connected Vehicles and Mobility Services.

Trusted partnership. Unlike others in the technology space, Microsoft is not looking to get into the business of making cars. Our strategy is to complement automotive firms, not to compete. Auto firms retain full ownership and control of their data and brand.

Microsoft Connected Vehicle Platform elements

Figure 1. Microsoft Connected Vehicle Platform at a glance



The Microsoft Connected Vehicle Platform is built on a set of core cloud services and productivity products. These include Microsoft Azure IoT Hub and related IoT services, Cortana Intelligence Suite and related analytics services, CRM integration through Microsoft Dynamics or any other CRM system, and a host of supporting capabilities for API management, location-based services, time series capabilities, and graph services. The platform is also architected to integrate with productivity tools like Microsoft Office 365, Cortana (an intelligent digital personal assistant) and Skype for Business.

At a basic level, Azure IoT Hub is used to communicate to send and receive messages from the car to the cloud. Additional core components process commands, store data, and create schedules and notifications, while extensions are used to create specific business case scenarios. These scenarios are powered by analytics capabilities in Azure: Stream Analytics, Data Lake Store and Data Lake Analytics for big data ingestion and analysis, and Machine Learning for predictive insights.

The Microsoft Connected Vehicle Platform pulls these capabilities together and delivers them in an integrated manner that addresses OEMs' and suppliers' most common challenges. It is not, however, a one size fits all approach; each OEM will have a customized version delivered through partnerships with approved systems integrators or managed services with Microsoft Consulting Services (MCS). This makes it easier for them to focus on delivering the differentiated experiences they want to bring to their customers.

Predictive services for greater reliability

ThyssenKrupp Elevator needed to build competitive advantage by increasing elevator reliability and uptime. Together with Microsoft and a technology partner, they developed a flexible solution that securely **connects thousands of sensors and systems to the cloud**. They have moved from a reactive to **predictive approach**, as technicians now use real-time data to identify faults **before a breakdown happens**. This gives ThyssenKrupp even greater visibility into and control over operations and maintenance, and opens new service opportunities.

Figure 2. Microsoft Connected Vehicle Platform key areas of innovation



Wearable remote voice control

Volvo Cars and Microsoft are enabling remote voice control through the Microsoft Band 2 (fitness band) and the Volvo on Call mobile app.

"With voice control, we are only just beginning to scratch the surface of what is possible with digital assistant functionalities."
 – Thomas M. Müller, Vice President Electrics/ Electronics & Chassis at Volvo Car Group

The following section addresses key areas of Microsoft support, which include:



Telematics and Predictive Services. These services combine vehicle telemetry with analytics to create useful insights for both the owner and OEM. Using near-real-time data from connected vehicles, OEMs and suppliers can gain better performance visibility and offer new services.

Traditionally, OEMs have not had the tools to consistently access and utilize vehicle telemetry data. But through remote connectivity and management capabilities in Microsoft's platform, automakers can ingest and process relevant data at scale. And by applying analytics, that data becomes actionable insight that OEMs can use to improve operations.

Remote vehicle management. Once a car joins a connected car platform, it inherently becomes an IoT-enabled device and requires lifecycle management, from provisioning all the way to decommissioning. Capabilities in the platform provide the visibility and control needed for lifecycle management, powered by cloud-based data ingestion and device visualization. With these capabilities, firms can determine device state, manage updates, and support ongoing operational processes. This helps OEMs and service providers maintain software and device integrity (and overall vehicle health), both at the individual vehicle level and across fleets.

Performance optimization, such as predictive maintenance. Optimizing vehicle performance involves combining telemetry data and remote management capabilities to power remote functions. For example, cloud-based predictive maintenance programs use the cloud-car connection to monitor systems in the car – brakes, transmission, or battery charge, for example – and send alerts if there are early-warning signs of a potential issue. These alerts can be sent directly to the vehicle owner or to a customer assistance center where personalized service recommendations are generated.

Over-the-air (OTA) updates. As cars become more connected, ongoing software updates are essential. Microsoft's platform supports OTA update capabilities, which enables

updates to be rolled out remotely and securely, without service downtime. This reduces costs and improves customer experiences.

Driver benefits. Telematics and predictive services offer several benefits to drivers. Predictive maintenance recommendations prevent unexpected breakdowns. Functions like “find my car” and remote lock-and-unlock make their lives easier. Remotely preset temperature, seating and other preconditions cater to their preferences, comforts, and needs.

Sample scenario: The vehicle collects battery usage data over time and sends it to the cloud. Machine learning analysis determines that the battery has a 70% likelihood of failure in the next 3 months. A predictive service recommendation is generated and sent to the user through their smartphone and in-car infotainment system, helping prevent the user from suffering through a dead battery in the dead of winter.



Productivity and Digital Life. In-car productivity services based on the Microsoft platform help to improve the customer experience. Customers are keen to use driving time more productively, as that time is a valuable commodity that is under-utilized – in the U.S. alone, car owners spend 75 billion hours a year driving.² Today, customers are primarily looking for improvements in voice recognition. Cortana, Microsoft’s intelligent, personal digital assistant, is the starting point for greater voice-enabled productivity, but the possibilities go well beyond voice command.

Microsoft is the first company to reach human parity in conversational speech recognition, and is now bringing that breakthrough technology into the connected vehicle. Cortana, already present on over 200 million Windows devices, addresses the challenge of discoverability; users will most likely be exposed to, and comfortable with, interacting with Cortana before they turn the key.

Integration with Microsoft Exchange, Office 365, and Skype gives Cortana contextual insight into a driver’s daily tasks and provides the ability to anticipate and meet their needs, from home to work and everywhere in between. Cortana is extensible through third party skills, enabling Cortana to bring a broad range of capabilities to the car, and be extended through custom integration for each automotive company.

Microsoft’s recent acquisition of LinkedIn creates additional possibilities for enhancing the productivity experience. Integrating Office 365 capabilities with the world’s leading professional network, for example, offers entirely new mobile productivity scenarios.

Productivity improvements also influence safety. Despite laws and products meant to curb distracted driving, the number of drivers using digital devices on the road has steadily increased.³ New productivity services offered through the platform will free up drivers to focus on the road, not on their mobile devices, creating a safer experience for everyone on the road.

Sample scenario: A driver is leaving for work, and their vehicle notes that a conference call will start while the driver is en route. During the trip, Cortana asks the driver if they want to join the call. The driver responds “Yes, thanks Cortana” and joins the call

Personal assistance in the car

Microsoft is working with BMW to enhance in-car productivity and set the foundation for future connected services. [BMW Connected](#) gives owners an intelligent, digital personal assistant that can look at calendar, traffic, parking, routing and countless other factors to deliver more intuitive and seamless experiences.

² Morgan Stanley, *Autonomous Cars: The Future is Now*, 2015.

³ Distraction.Gov, [Facts and Statistics](#), 2016.

automatically, without being distracted by entering a conference code. The call audio is played over the car speakers. During the call, some important emails come in, and the driver mutes their microphone and listens to them using voice command. During the trip, the vehicle detects via Office 365 integration that the next meeting location has changed, and automatically suggests a new route.



Connected Advanced Driver Assistance Systems (ADAS). Connected ADAS support builds on current safety capabilities in vehicles today. It requires not only the right hardware, but also the right software algorithms and OTA update capabilities to keep those algorithms current.

Deep neural network-based analytics built on the Microsoft platform, applied to data coming from ADAS components such as cameras, radar, LIDAR, and proximity sensors, will fuel cloud-learned algorithms. These predictive models can then be deployed to the vehicle, creating a stronger layer of safety around the car. Predictive models are then combined with contextual data about the environment – road conditions like potholes, obstacles, or accidents – to create a real-time graph of precisely where objects are. This graph is displayed on existing high definition maps for safer manipulation of the ride.

Connected cars can share this information with other vehicles, devices, and public infrastructure systems so other drivers can make predictive decisions. Increasingly, these predictive decisions will be made automatically to avoid accidents, protect the value of the car, and keep the flow of traffic moving. Along with innovations in navigation, these contextual awareness advances will set the stage for fully autonomous vehicles.

Sample scenario: A stray piece of debris is blocking a lane of traffic. The connected ADAS system in the lead vehicle recognizes the debris and communicates that information to approaching cars, helping them proactively adjust to the slowdown.



Advanced Navigation. The next generation of navigation systems will go beyond directions from point A to B to provide a more informed, dynamic experience. Today, navigation data (maps, weather, traffic, parking information, road closures, etc.) lives in siloes that do not cohesively integrate with one another. The Microsoft platform brings data from disparate systems together, and uses analytics to map the environment and uncover insights. This unified view enables optimized routing through highly automated driving (HAD) maps, and improves location-based services.

HAD maps are highly accurate and updated in real-time based on what the car sees and reacts to, including road conditions like construction, potholes, or debris. HAD maps look at the entire environment using data from other connected vehicles, grids, and infrastructures, and can proactively make decisions based on that data. This real-time accuracy and contextual awareness, plus driver behavior data, enables optimized routing.

Optimized routing uses real-time environmental analysis to create intelligent directions. Directions can be based on several factors that affect driver experience, like connectivity, likelihood of an accident, and fuel economy. Routing based on selective factors like these can lower risk of accidents, save fuel costs, and preserve the long-term health of the vehicle. Optimized routing also works with productivity features, enabling the vehicle to plan routes based on driver context, like the location of their next meeting. It can also consider new factors as semi- and fully autonomous vehicles become more common.

IoT weather apps improve driver safety

When developing their sophisticated IoT weather tracking solution, [Fathym](#) needed a cloud platform with **best-in-class flexibility and speed of deployment**. With Microsoft Azure, they successfully built out a **full ecosystem of IoT microservices** to help improve maintenance, commuting, and routing operations by providing accurate, hyper-local road conditions. The scalability and speed of the platform, enabled Fathym to scale, grow, and **transform their businesses**, translating to both **cost savings** for Fathym and **safer roads** for the cities they support.

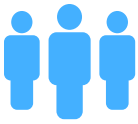
Optimizing traffic with IoT

The [Land Transport Authority of Singapore \(LTA\)](#) understood that **real-time insights** could be the key to improving traffic flows in their most densely populated areas. Since 2011, LTA has hosted a **rich repository of land transport data** on the Microsoft Azure platform to help citizens make better commute decisions. They also make the data **available to the public**, empowering developers to build **unique, powerful mobile apps**.

Location-based services, such as geo-fencing and geo-tracking, leverage navigation capabilities to improve users' experiences. For example, if a car is left with a valet, the driver can be alerted if the car leaves a certain radius, providing peace of mind and security. Similarly, parents can be notified if a teenager's car leaves a designated area.

These are a few examples of how Microsoft is helping OEMs improve navigation today. Longer-term, Microsoft's Connected Vehicle Platform capabilities will continue to evolve and help OEMs offer a completely new navigation experience.

Sample scenario: A car knows that its driver leaves for work at 7:55am every day. It detects that the driver has an 8:00am meeting, and selects and suggests a different route based on optimal cell connectivity for the call, rather than the shortest trip duration.



Customer Insights and Engagement. Connected cars transform the relationships between OEMs and customers, and provide tremendous benefits for both groups. That concept is at the heart of Microsoft's platform. In fact, stronger customer engagement is often a natural outcome of providing connected car capabilities. Telematics and predictive services, productivity tools, connected ADAS, and new navigation options all help to increase brand stickiness and loyalty.

For customers, connected cars offer new types of interaction and control. Digital touchpoints can extend across the user's entire day. For example, mobile alerts combine location data, traffic, and calendar information to alert the driver when it is time to leave. The system can even message meeting attendees automatically if the user is running late. Through integration with Cortana, an OEM could give drivers hands-free access to their custom mobile app.

Mobile integration is just the starting point – connected cars work with the whole spectrum of a customer's devices, from smartwatches to PCs. These devices can be used to control the car and view vehicle performance, health, and driving history. Essentially, connected cars can become extensions of customers' digital lives, enabling more intuitive, frictionless experiences.

For OEMs, connected cars offer the opportunity to strengthen customer engagement through new and better experiences. Traditionally, carmakers had little data on their customers; dealerships largely owned the end-customer relationship. Today, some OEMs are already establishing deeper connections through apps that give customers control over the in-car services they want. Connected cars build on those capabilities by using car- and driver-generated data and analytics to provide insight into preferences, habits, and trends. This is the foundation for services of all kinds, which can increase customer engagement and loyalty, and create new revenue opportunities.

The long-term vision for the OEM-customer connection is tailored, personalized experiences. With a better understanding of customer behaviors and preferences, automakers can deliver greater value, not only during the life of the car, but across the customer's lifetime engagement with the brand.

Sample scenario: Having opted into an OEM loyalty program powered by Dynamics 365, a driver's car can proactively provide special offers based on awareness that they frequently visit a restaurant in a busy part of town. The OEMs CRM system suggests a

On-demand technical capabilities

Toyota is partnering with Microsoft to launch [Toyota Connected](#), which will **expand their mobile and data analytics capabilities** to enable in-car services, personalized experiences, better safety, and smart city integration, among other scenarios.

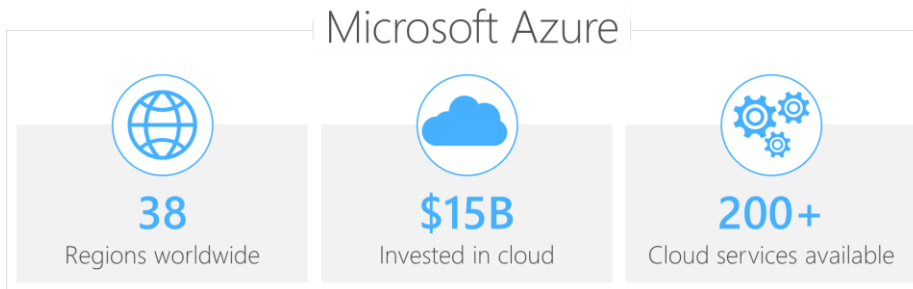
parking services application that can automatically reserve a parking spot near the destination, and delivers a discount coupon for a new item at that restaurant.

Why build on Microsoft's platform?

The innovative scenarios that Microsoft's Connected Vehicle Platform supports are backed by an unrivaled set of technologies as well as an approach grounded in deep experience. Following is an overview of the advantages Microsoft's platform brings.

Leading, innovative technologies

Global cloud infrastructure. Microsoft is one of only a few firms with the global, hyper-scale cloud needed to support end-to-end connected car solutions. The Microsoft Azure cloud provides global coverage via 38 datacenter regions worldwide. By leveraging the years and billions of dollars Microsoft has invested in Azure, OEMs can get to market faster and eliminate the burden of infrastructure set-up and maintenance. Microsoft continues to invest in expanding Azure, and is the largest investor in dark fiber, MPLS connectivity, and the undersea cables that provide ultra-fast connectivity.



Robust security, compliance and privacy measures. Security, compliance and privacy are imperative for connected car solutions. Microsoft's cloud infrastructure is resilient to attack, protects access, and helps keep data secure at every step of the way. With more certifications than any other cloud provider, Microsoft's cloud meets a broad set of international standards and compliance requirements. This ensures solutions can scale globally, from Europe to China to North America and beyond. Microsoft is fully committed to protecting the privacy of customer information. OEMs and suppliers own their data, and maintain full control over any offerings built on the Microsoft platform.

End-to-end analytics solutions. Analytics are critical to enabling connected car services and providing benefits such as greater insight into vehicle usage. Consequently, a platform with a strong analytics backbone is vital to success. Microsoft has an unparalleled analytics portfolio that spans the full range of connected car needs, from collecting and storing data to mining it for insights and feeding those insights into business operations. The Microsoft Connected Vehicle Platform pulls the required

capabilities together, including big data, information management, data modeling, data visualization, predictive analytics, machine learning and deep learning.

Innovative artificial intelligence (AI) capabilities. Microsoft offers a range of AI capabilities that OEMs and Tier one suppliers can build into their solutions. These include Cognitive Services, a new collection of intelligent APIs that can interpret speech, recognize faces, understand language, and more. Using these capabilities, connected car solutions can interact with drivers to promote better experiences—for example, a car could recognize driver emotion and fatigue, and react accordingly. When combined with analytics like machine learning, connected car solutions can use human-computer interactions to support intuitive, predictive, and personalized recommendations.

Internet of Things (IoT) expertise. Microsoft's approach to connected cars is informed by decades of experience in the connected things space, from machine to machine (M2M) technologies, to Windows Embedded, and now Microsoft Azure IoT services. Platform capabilities include device management, preconfigured solutions for common scenarios, real-time, streaming data processing, and other services necessary for working with connected devices at scale.

A set of industry-leading productivity tools. Microsoft has an unparalleled track record of delivering leading productivity solutions. Our productivity tools allow people to shift their experiences fluidly and securely, and extend them into the physical world – particularly important for enabling transitions across the home, vehicle and workplace.

An ecosystem-centric approach that adapts to customer needs

Enterprise experience. Microsoft has deep experience working with enterprises, with decades of experience helping customers with complex cloud, data integration, system integration, security, brand identity, and productivity needs.

Consultative strategy to help maximize customers' ROI. Microsoft takes a consultative approach to help firms determine the best way to secure value from connectivity. Our platform provides a foundation for custom solutions, such as usage-based insurance that draws on vehicle usage data. Using data in innovative ways can help defray the cost of connectivity technologies. Many firms are exploring ways to do this, from including costs in the upfront vehicle price to offering subscriptions or trials.

Partner ecosystem support. Microsoft's platform is built for integration, enabling a broader ecosystem. OEMs and Tier one suppliers may need to stitch together data from mapping, insurance, satellite radio, telco, and other providers. This requires horizontal integration with other products and solutions, which the Microsoft platform is designed to support. The platform also provides a basis for better collaboration and data sharing, should an OEM and partner have an agreed-upon model for data federation. The platform facilitates this by providing the technical foundation for collecting and retaining data from different stores, where they can be integrated, analyzed, and virtualized upon request. These capabilities will be increasingly integrated as new business models are developed.

Opportunities for automotive firms

Connected car solutions offer OEMs a wide range of benefits

For automakers, connected car solutions based on Microsoft technologies offer incredible value. Below are examples of the kinds of opportunities OEMs are seeing.

Save money on updates, warranty issues, and recalls. Through platform capabilities like OTA updates, OEMs can detect issues and roll out updates directly and securely, without downtime. The ability to manage updates, parts, and warranties more cost-effectively can translate into a potential savings of billions.⁴

Promote safety. Connected cars can support more engaged, focused driving, which enhances safety and brand reputation. Better voice recognition and cameras with facial recognition can be trained to recognize distraction and fatigue, keeping drivers focused and helping prevent accidents.

Increase customer engagement and offer tailored experiences. Thanks to always-on connectivity and data streams, OEMs are gaining greater visibility into how customers are using their vehicles, both individually and in aggregate. Connected car data can also be used to tailor a driver's experience, as the car learns to anticipate and react to the driver's preferences and habits.

Improve sales and marketing efforts. By integrating telemetry data with customer relationship tools, such as Microsoft Dynamics 365, automakers can improve digital sales and marketing strategies and create more targeted suggestions and offers. This data can also be used to inform partnerships with other companies that help OEMs and customers gain even more value.

Develop new business models and scenarios. Pervasive connectivity and customer insight enables OEMs to build new business models. Customers are placing increasing value on the services an OEM offers, not just on the physical car. Unifying siloed data sets in a common environment can help OEMs uncover new opportunities. Rolls-Royce, for example, delivered a solution that leverages Microsoft Azure IoT Suite and Cortana Intelligence Suite to offer predictive insights and maintenance to their customers, improving the uptime and ROI of their engine assets.

Transform the broader enterprise to optimize current and future products. Microsoft's platform helps OEMs and Tier one suppliers capture greater value across the entire enterprise – from product development to supply chain, manufacturing, and delivery. Insights into feature usage can help design teams make intelligent decisions regarding what is useful to customers and where to invest for future designs. Wear and tear data from sensors in the vehicle indicate which parts are working well and what is

Pioneering Highly Autonomous Driving

IAV Group, an engineering and technical consultancy, partnered with Microsoft to develop the **Connected Highly Autonomous Driving (CHAD) vehicle**, capable of detecting and mitigating hazards. [Learn how they leveraged Azure and Windows 10](#) to pioneer the next generation of productivity and safety.

⁴ Frost & Sullivan, [Over-the-Air updates to slash automobiles' recall rates](#), 2013.

breaking down prematurely, allowing engineers to improve designs as needed and pass that information on to supply chain partners for further improvements.

This information can also be used to drive greater efficiencies in manufacturing and vehicle delivery. If an OEM learns that a certain part has a high likelihood of failure, they can identify a specific piece of machinery or step in the process that is responsible. This can be the foundation for deeper automation and digital transformation in the factory, leading to greater uptime and better inventory management. By adding sensors to delivery trailers and the cars themselves, OEMs and dealers can know exactly where their inventory is at any given time, and can set up alerts based on certain conditions.

The role of the ecosystem

Connected car solutions involve an ecosystem with traditional value chain players – OEMs, Tier one suppliers, systems integrators, solution providers – as well as an evolving digital ecosystem of service providers delivering new driver experiences, mobility services, insurance models, city infrastructure integration, and more. Microsoft is committed to fostering a connected-car ecosystem that enables an open approach that is inclusive of these roles. For instance, Microsoft is working with Tier one suppliers to plan around standard hardware capabilities, enabling OEMs to work with the hardware of their choice while meeting common needs. Opportunities go beyond automotive to include larger societal benefits, including smart cities, insurance, multi-modal transportation, car sharing, and many other use cases related to the connected car.

Suppliers. Microsoft's platform enables suppliers to build integrated hardware and software solutions that they can sell to OEMs. As car sensors become more prominent, Tier one suppliers have an opportunity to build assets that improve the performance and safety of the car. For example, using current engine performance data, a Tier one supplier could predict a needed replacement for a faulty part and alert the OEM or local service center. Suppliers can also plan around the productivity capabilities in the platform. Fully integrating Cortana directly into the head unit, for example, eliminates the need for Bluetooth or USB connections, easing the pain of in-car set-up. Cortana's deep, backend integration with navigation, media, and communication systems gives OEMs control over their branded experiences and in-car design. And Cortana can be integrated into any head unit, on any platform, giving OEMs even greater choice and control.

Systems integrators and consulting services providers. No two connected car solutions will be the same. Each one will be purpose-built for an individual OEM. Given that, Microsoft's platform approach relies on systems integrators and consulting services providers, including Microsoft Consulting Services, to bring platform and OEM systems together to create cohesive and unique solutions. They will work with OEMs and suppliers on last-mile differentiation, regional-specific needs, testing, deployment, and maintenance. This could include OTA updates, diagnostics services, custom applications, or specific security requirements. Integration with CRM systems, device management services, various apps, and third-party solutions is also an area where systems integrators will augment OEM and supplier capabilities.

Solution providers. Because the Microsoft Connected Vehicle Platform isn't a complete solution, but rather the foundation for one, there is endless room for customization and differentiation by vertically specialized firms. Solution providers can innovate on the platform by developing custom solutions for OEMs for a wide range of scenarios.

Fleet management, for example, represents a significant opportunity for solution providers to deliver specialized applications that enable new business models. Here, solution providers can deliver capabilities in shipping, ridesharing, and other mobility services. These capabilities can include tracking, coordinating, and directing vehicle location, brokering rideshare agreements between parties, or scheduling maintenance. Fleet management apps can be developed on the platform and delivered as part of an OEM's services portfolio (via a custom app) or as a standalone service that can address a wider array of mobility needs in the market.

An expanding digital ecosystem brings innovative services around the connected vehicle

Connected cars solutions can involve digital services providers and a broad ecosystem that goes well beyond traditional firms. These include:

Smart cities. Connected vehicles can integrate with smart infrastructure, inform other vehicles about hazards, communicate with each other to smoothen traffic flows and reduce emissions, ease the burden of parking, and contribute data essential for improved public services.

Insurance. With the ability to monitor driver behavior, vehicle condition, and environmental context, insurance companies can focus on alternate models, such as usage-based insurance, and promote incentives to improve safety and reduce risks of accidents.

Logistics. Much of the manufacturing & distribution world now operates on just-in-time principles. With connected trucks, fleet operators can provide real-time signals on precise delivery timeframes to provide advanced inventory visibility for customers to plan against, easing the impact of delays or breakdowns.

Public services. Emergency and law enforcement vehicles, sensorized with cameras and productivity tools, can help accomplish their objectives more efficiently and reduce time spent on paperwork and administrative tasks.

Retail and eCommerce. Personalization allows retailers and advertisers to engage consumers during their drive, in partnership with OEMs and Tier one suppliers, surfacing points-of-interest and offers related to their habits, preferences, or impulsive instincts. Enabling transactions via the vehicle-as-a-merchant terminal reduces friction and improves convenience.

These are just a few of the possibilities that the Microsoft Connected Vehicle Platform lights up. With Microsoft's platform approach, OEMs and ecosystem players have the flexibility to pursue a nearly limitless array of use cases.

Conclusion

Planning and executing on a connected car strategy now is essential. The market is moving rapidly, and those who move quickly will be well-positioned to capture mindshare and market share. Microsoft's Connected Vehicle Platform aggregates the building blocks needed to get you as close as possible to a market-ready product and enables an ecosystem of partners to take you the rest of the way. Whether you're just getting started or need help scaling existing investments, Microsoft can help you navigate the tough decisions around the right connected car technology for your business.

In navigating the transforming industry landscape, automakers have many options. Imagine if the infrastructure-focused heavy lifting was done for you so that you could focus on designing new monetization opportunities and building specialized experiences that customers are looking for. This is the vision of Microsoft's Connected Vehicle Platform.

Next Steps

- Visit <http://aka.ms/mcyp> to learn more about Microsoft's Connected Vehicle Platform
- Contact your Microsoft representative to arrange a workshop or strategy discussion
- Schedule time with Microsoft Consulting Services to discuss how to adopt and deploy the Microsoft Connected Vehicle Platform efficiently and cost-effectively

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