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Enabling connected vehicle solutions

Seizing the connected vehicle opportunity with Microsoft

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Executive Summary

The automotive industry is going through a massive transformation, driven by breakthrough technology and heightened connectivity. By the year 2030, it is estimated that all new cars will be digitally connected. In this new landscape of connected vehicles, automakers, established and emerging transportation solution providers, and technology companies like Microsoft are working together to accelerate this innovation one step further.

Together, we're making the Internet of Things *mobile*, creating next generation, connected mobility solutions that unite the intelligent cloud and intelligent edge in the vehicle. These solutions require a platform infrastructure that's global, flexible, scalable, and secure, and an ecosystem of System Integrators (SIs) and Independent Software Vendors (ISVs) that provide key last-mile differentiation by customizing and continually innovating using a consistent, agile platform. That's why automotive industry leaders are partnering with Microsoft to build smart, connected mobility solutions and services, enabled by the Microsoft Connected Vehicle Platform (MCVP).

MCVP offers the consistent technology infrastructure and support to integrate vehicle assets and solutions, via secure, scalable data ingestion into a common data lake. From there, automakers and partners can use vehicle telemetry to create customized, breakthrough, consumer value added in-vehicle and cloud services – including telematics, navigation, productivity services, and much more. Furthermore, the capabilities of MCVP extend beyond passenger vehicles to include commercial and industrial vehicles – from cars and trucks, to cranes, ships, and drones. MCVP provides IoT for things that move.

With the help of our partner ecosystem, MCVP allows vehicle makers control and flexibility for creating differentiated, intelligent, connected mobility experiences for their customers, allowing partners to integrate the hardware, software, and first or third-party solutions of their choice.

Transformation is happening fast. Go faster, with the Microsoft Connected Vehicle Platform.

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Contents

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Digital transformation & the connected vehicle

Digital transformation is redefining what vehicles can do and what people expect from them. The foundation for this shift is that vehicles are becoming more connected. This connected vehicle environment creates a path to safer, higher quality products, new business models, 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) scenarios.

As an example, 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-1 suppliers plan, engineer, build, deploy, market, and maintain product quality and safety.

The opportunities to foster deeper customer relationships and meet growing customer expectations can be met by utilizing a common connected vehicle platform across all vehicle-to-cloud, cloud-to-vehicle and system-to-system services workloads, enabling contextually aware user experiences for drivers, passengers, and riders.

Building vs. Buying a Connected Vehicle Solution

When building a connected vehicle solution, automotive players commonly select one of two approaches: First, they can build solutions leveraging IaaS and PaaS cloud services, and second, they can select a SaaS offering that provides fully managed solutions.

The first approach allows partners to develop entirely bespoke IP that is designed and optimized for the specific needs of the partner. This in-house approach is expensive to build, time-intensive**,** and requires extensive expertise spanning multiple disciplines, including automotive hardware, cloud services, and intelligent edge solutions. Historically, this approach has led to the rise of multiple connected vehicle platforms coexisting within the same customer's purview – leading to a fragmented, interrupted in-vehicle experience.

The second approach entails working with a SaaS offering, which provides the benefit of accelerated time-to-market and reduced infrastructure development and maintenance costs. This can, however, result in greater limitations for solution customization, especially as it relates to deploying new consumer facing services based on machine learning (ML) or artificial intelligence (AI) across telemetry. Furthermore, customers who choose this approach frequently have limited access to their own telemetry data, which would limit their in-house ML and AI efforts.

Microsoft's approach

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Accelerating innovation with the Microsoft Connected Vehicle Platform

MCVP introduces a third approach that integrates the benefits of both historical approaches. In partnership with Microsoft, OEMs and suppliers can leverage MCVP to build the core infrastructure underlying most connected vehicle solutions – addressing fundamental requirements such as high availability, global connectivity, and secure, authenticated access. This allows OEMs to move up the stack and allocate their resources toward building the differentiated components of their connected products or experiences that closely align with their areas of expertise.

Our platform brings together the best of Microsoft technology – including IoT, security and connectivity and edge services, to create an automotive grade, cloud-based data pipeline implementation for secure, hyperscale communication between vehicles and their end connected mobility services (such as telematics, diagnostics and remote vehicle feature control). MCVP funnels vehicle sensor telemetry into a unified data lake on Microsoft Azure, over which OEMs and partners can deploy artificial intelligence, 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.

This ensures that partners can have maximum customization and integration with present and *future* services, enabling the continued support and innovation of their long-term vision to enable new intelligent services and user experiences.

Furthermore, Microsoft does not compete with partners for market share or brand loyalty, having designed the platform to allow partners to differentiate their ultimate solutions under their brand, and to deploy MCVP with the Tier-1 suppliers and 3rd party service providers of their preference.

Core attributes of our approach include:

Flexibility and control. Through our discussion with incumbents in the automotive space, we've learned that flexibility and control are essential. With that in mind, the platform is not an in-vehicle 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, OEMs can work with SIs 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 vehicle 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 vehicle.

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

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.

"Today we are deploying a vehicle connectivity platform that will transform the digital experience for customers of Renault, Nissan, and Mitsubishi. Through our collaboration with Microsoft, we are introducing the **most powerful and far-reaching connected vehicle platform**. Leveraging the size and scale of the Alliance, we have **built an intelligent cloud platform that sets the pace for our industry**,"

– Kal Mos, Global Vice President of Alliance Connected Vehicles at Renault-Nissan-Mitsubishi

by integrating with and unifying existing solutions, simplifying operations, and enabling new capabilities and scenarios.

Trusted partnership. Microsoft is not looking to get into the business of making automobiles. Our strategy is to complement automotive firms and not to compete with them. OEMs retain full ownership and control of their data and their brand.

Microsoft Connected Vehicle Platform elements

MCVP provides a consistent technology foundation for cloud, vehicle, and other connected user experiences. It is a system of cloud services that provide connected vehicle infrastructure functionality in an Azure environment. OEMs and their partners can then accelerate their development of solutions, minimize their cost of development, ensure security and compliance best practices, and maximize the benefits of Azure resources.

At a basic level, MVCP is used to communicate to send and receive messages from the vehicle to the cloud, as well as commands from the cloud to the vehicle. Additional core components process commands, store data, and create and send notifications, while MCVP's extension mechanism can be used to enable specific business case scenarios. These scenarios can be 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.

MCVP 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 SIs or managed services of their choosing. This makes it easier for them to focus on delivering the differentiated experiences they want to bring to their customers.

MCVP also provides a claims resolver service that defines and authorizes the connected/in-vehicle capabilities that are allowed by specific vehicles or users and associates vehicles with their appropriate owners. For instance, when a user sends a command to a vehicle ("unlock doors"), or MCVP receives incoming telemetry from a vehicle, MCVP calls the claims resolver to authorize the request.

Enabling global, reliable connectivity

"As global car manufacturers undertake to digitally transform their businesses, they are fueled not just to achieve improved **economies of scale**, but rather to meet the **scalability requirements** for application processing, performance, **storage, security and software updates**."
Barry Napier, Cubic Telecom CEO

Why build on Microsoft's platform?

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

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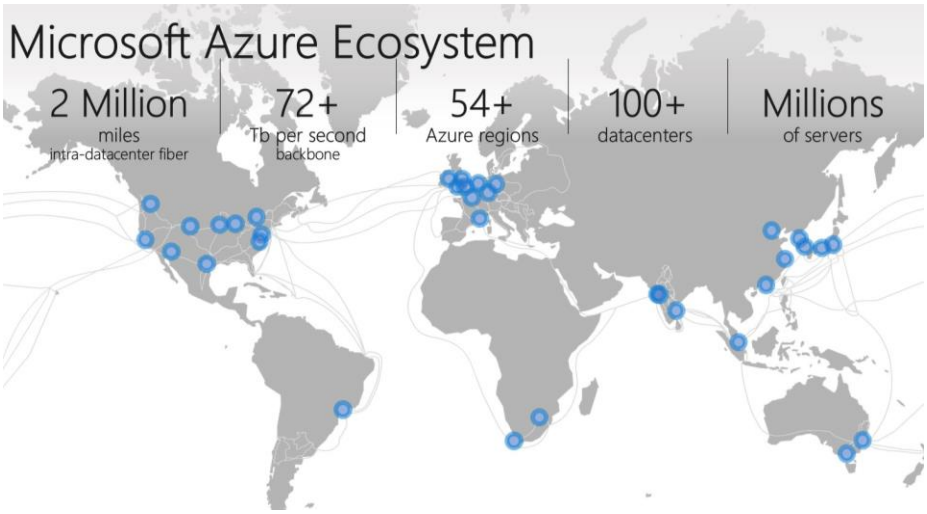
Leading, innovative technologies

Global cloud infrastructure. Microsoft is one of only a few firms with the global, hyper-scale cloud needed to support end-to-end connected vehicle solutions. The Microsoft Azure cloud provides global coverage via 54 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 vehicle 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 vehicle 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 vehicle needs, from collecting and storing data to mining it for insights and feeding those insights into business operations.

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 vehicle solutions can interact with drivers to promote better experiences—for example, a vehicle could recognize driver emotion and fatigue, and react accordingly. When combined with analytics like machine learning, connected vehicle solutions can use human-computer interactions to support intuitive, predictive, and personalized recommendations.

Internet of Things (IoT) expertise. Microsoft's approach to connected vehicles 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. 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.

Partner ecosystem support. Microsoft's platform is built for integration, enabling a broader ecosystem. OEMs and Tier-1 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.

The role of the ecosystem

An expanding digital ecosystem brings innovative services around the connected vehicle

Connected vehicles 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, enhanced with sensors (such as 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-1 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.

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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 vehicle strategy now is essential. Microsoft recognizes the massive, rapid change the automotive industry is going through. In navigating the changing industry landscape, automakers have many options in this environment, and those who move quickly will be well-positioned to capture mindshare and market share. MCVP 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 vehicle technology for your business.

Next Steps

- Visit http://aka.ms/mcvp to learn more about Microsoft's Connected Vehicle Platform
- Contact your Microsoft representative to arrange a workshop or strategy discussion
- Contact mcvpsales@microsoft.com with direct inquiries