

# MOBILITY TECHNOLOGIES RESHAPE THE NATURE OF VEHICLE USE

SOLUTION BRIEF



In another game-changing development, software competence is increasingly becoming one of the most important differentiating factors for the industry. The program code for the modern car has approximately as many object instructions as an aerospace flight control system.<sup>1</sup>

## PERSONAL TRANSPORTATION EVOLVES

Mobility—a strong force spurring disruptive change in the automotive industry—takes different forms, tackles different challenges, and is enabled by different technologies that often provide complementary capabilities. Electro mobility (sometimes called e-mobility)—indicating the transition toward clean, efficient, electric vehicles—is closely linked to smart grid development and an intelligent charging infrastructure. Mobility sharing—the short-term use of a vehicle by one or more persons—lets users requisition transportation as needed, typically coordinated by a central application accessed by mobile services. Personal mobility—the convergence of the connected car and extended personalized services—elevates the automobile beyond basic transportation to a combination intelligent assistant, concierge, coach, communication hub, and safety inspector. Ride-hailing services, powered by mobile applications, were originally only available in dense urban areas. These services are now expanding to smaller cities and towns. Other applications of mobility that reshape personal transportation continue to evolve as new technologies are developed. Intel and Red Hat are leaders in this space.

## TECHNOLOGIES UNDERLYING THE CONNECTED CAR

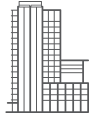
Advances in mobility are providing innovative new customer experiences, connected car advances, and unprecedented communication capabilities. These accomplishments are not confined to just the connected car alone, but extend across connected things in the Internet of Things (IoT) space, including the digital home, the smart city, the travel and hospitality industry, the automotive parts and service ecosystem, and other areas. Automakers are rethinking the ways new services can be delivered to customers and using mobile services as a mechanism to push information, guidance, and warnings to users.

Collaborative Intel and Red Hat work on many of the technologies that are powering the mobility revolution has contributed to notable advances in this sector. Among the mobility milestones are advances in 5G communication, comprehensive mobile app development tools, middleware applications that enable IoT deployments, improvements in Wi-Fi communications, IoT gateways, advanced analytics coupled with artificial intelligence, in-vehicle telematics, and enhanced machine learning.

Mobility is quickly becoming an integral part of automotive operations in the digital age. Recent advances promise to change the ways in which automakers develop and design vehicles, manufacture them, and maintain connections with car owners over the lifetime of the vehicle.

## 5G ENABLES MANY CONNECTED CAR CAPABILITIES

Mobile communications in the automotive sector rely on massive volumes of data transfers. Within a few years, this will scale to zettabytes of data from an estimated 50 billion IoT devices. 5G—the rising de facto standard for mobile and wireless communications—can handle voluminous data transfers to and from vehicles. Building blocks from Intel for 5G network infrastructure support extended connectivity—from automotive-related data stores to and from a variety of edge devices and across



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Red Hat is the world's leading provider of open source software solutions, using a community-powered approach to provide reliable and high-performing cloud, Linux, middleware, storage, and virtualization technologies. Red Hat also offers award-winning support, training, and consulting services. As a connective hub in a global network of enterprises, partners, and open source communities, Red Hat helps create relevant, innovative technologies that liberate resources for growth and prepare customers for the future of IT.

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central datacenter server resources. Aggregated and analyzed data becomes the information source for enabling connected car capabilities, which support autonomous driving, safety warnings, weather advisories, route selection, predictive vehicle diagnostics, and more. This technology can be applied across three categories of communication services: enhanced mobile broadband, massive machine-type communications, and ultra-reliable and low-latency communications. These services are discussed in greater detail in "*IMT Vision – Framework and overall objectives of the future development of IMT for 2020 and beyond*," produced by ITU-R. Many of these communication services support the capabilities of the connected car. For example, smart city services can notify drivers of available parking spots, recommended routes free of congestion, or problem areas during natural disasters. Industry automation links partners across supply chains helping keep auto manufacturing lines efficient and productive.

Co-engineered technologies from Intel and Red Hat are enabling widespread 5G technology as the basis for greater connectivity, including IoT solutions and wireless links to the cloud. The Intel® IoT Gateway provides filtering and first-stage analytics for sensor and device data collected at the edge (for example, telematics that provide precise details about vehicle status), separating relevant information from noise. Solutions based on the Red Hat® Cloud Infrastructure support the development of massively scalable datacenters that adapt and respond dynamically to bandwidth and resource demands of IoT-based networks.

## TECHNOLOGIES THAT SUPPORT MOBILITY SERVICES

Many of the supporting technologies to enable digital services for automotive uses, ride-sharing services, intelligent electric vehicles, and personal mobility are in areas where Intel and Red Hat are providing industry leadership. These technologies include:

**Red Hat OpenShift:** This Platform-as-a-Service provides secure delivery of connected car applications using container technology and Kubernetes management capabilities, as well as streamlined development on public or private clouds.

**Intel® Open Network Platform:** Software-defined networking for IoT implementations can be orchestrated and managed using this reference architecture, which includes a complete open source software stack and validated interoperable components.

**Red Hat Gluster Storage and Red Hat Ceph Storage:** Software-defined storage with these Red Hat solutions, optimized for Intel® Solid State Drives, simplifies the handling of rapidly changing storage requirements encountered in 5G networks and IoT infrastructures.

**Red Hat Mobile Application Platform:** This platform accelerates the development, integration, and deployment of mobile applications with full support for back-end operations and connectivity with mission-critical enterprise apps.

## THE PATH GOING FORWARD

The growing importance of mobility in the automotive sector has led to a groundswell of innovative solutions, offering practical, real-world implementations of IoT and helping advance 5G network infrastructure development as a foundation for next-generation mobility. Red Hat and Intel are committed to developing co-engineered solutions that capitalize on these trends and help shape the future of the automobile industry.