

# SETTING THE FRAMEWORK FOR CAR CONNECTIVITY AND USER EXPERIENCE

The connectivity experience of drivers and passengers will soon be transformed, with the potential for significant value creation. Here is a framework to measure progress.

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In the automotive sector, as elsewhere in the economy, digital forces are blurring traditional industry boundaries, spurring the formation of new ecosystems, and placing large profit pools up for grabs. Vehicle data, spun off by surging vehicle connectivity, will be critical for generating revenue, reducing costs, and increasing safety and could represent a value pool of up to \$750 billion by 2030.

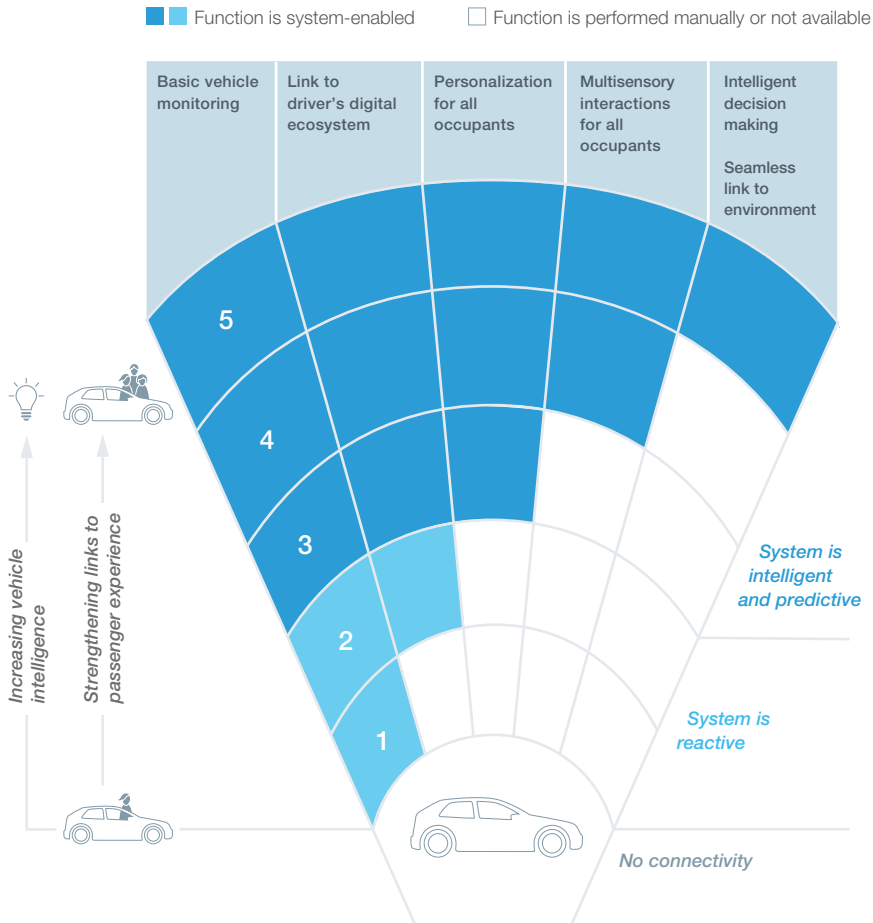
The value of this data will depend in part on the acceptance of clear-cut standards. A common understanding and shared language will help players across the ecosystem communicate about current and emerging opportunities. It will also make it easier for consumers to compare features and capabilities of different offerings. No such standard exists today for user experience in a connected car, one of the key foundations for data-driven value creation in mobility. As connectivity systems become progressively more complex, understanding the changes underway will become increasingly problematic in the absence of a universal framework. In this article, drawn from years studying this topic, we propose one.

## The role of frameworks

To understand the role of generally accepted standards, look no further than the framework for levels of vehicle autonomy, advanced by the Society of Automotive Engineers (SAE) automation taxonomy. The SAE taxonomy is at once comprehensive and simple. At each ascending level of automation capability, only one new element is introduced at a time. Such stark classification reflects an engineering-oriented approach—yes or no, zero or one. Through three years of cross-industry research, multiple global roundtables, 3,000 consumer interviews and more than 100 interviews of executives from companies ranging from start-ups to large corporations, as well as our experience serving clients on this topic, the McKinsey Center for Future Mobility has been seeking to bring similar clarity to each distinct step change in connectedness achievable in the coming months and years. The product of those efforts is a framework to measure vehicle connectivity and the user's experience: the McKinsey Connected Car Customer Experience (C<sup>3</sup>X) framework (exhibit).

Exhibit

The McKinsey Connected Car Customer Experience (C<sup>3</sup>X) framework describes five levels of user experience in connected cars, ranging from the most basic to the highly complex.



**1 General hardware connectivity**

**Driver** able to track basic vehicle usage and monitor technical status

**2 Individual connectivity**

**Driver** uses personal profile to access digital services via external digital ecosystems and platforms

**3 Preference-based personalization**

**All occupants** enjoy personalized controls, their own infotainment content, and targeted contextual advertising

**4 Multimodal live dialogue**

**All occupants** interact live with vehicle and receive proactive recommendations on services and functions

**5 Virtual chauffeur**

**All occupants'** explicit and unstated needs fulfilled by cognitive AI that predicts and performs complex, unprogrammed tasks

Whereas autonomy and its levels can be defined as the extent to which drivers control how automobiles move (from full driver control to no human intervention at all), connectivity should be defined based on what car riders experience. The distinction is not academic. Connectivity, in large part, will be key to using car data to generate revenue, optimize costs, and improve safety. Artificial intelligence (AI) will be used to anticipate and respond to vehicle occupants' needs and commands, leveraging in-vehicle sensors and data on consumer preferences from multiple digital domains, including social media, connected home, and connected office.

The more seamless a rider's experience becomes, the more opportunities there will be to affect revenue, cost, and safety. As technology in the connected-car ecosystem becomes more sophisticated, consumer expectations will evolve in parallel, creating a need to deliver higher-value user experiences. The C<sup>3</sup>X framework makes it easier to quantify value-creation opportunities associated with increased connectivity. Players across the entire ecosystem will be able to understand with greater precision what's necessary to take user experience to (quite literally) the next level and how much value they will be able to generate through a connected vehicle across these levels.

### **Breaking down vehicle connectivity**


Under the C<sup>3</sup>X framework, general hardware connectivity (level one) means

that the vehicle allows for only basic monitoring of its use and technical status, and individual connectivity (level two) means that the vehicle can use a driver's personal profile to access services on external digital platforms such as Android Auto and Apple CarPlay. The data monetization for these levels is already core to how multiple businesses make money, particularly (but not exclusively) digital natives. Automakers too are starting to monetize connectivity; consumers are coming to demand and pay for basic connectivity features such as in-vehicle hot spots and usage-driven maintenance checkups.

Moving up the scale, when the user experience shifts from reactive to intelligent and predictive thanks to artificial intelligence, the value-creation opportunities are amped up significantly. At level three, focus expands beyond the driver and onto all occupants, who are afforded personalized controls, infotainment, and advertising. Level four provides live interaction through various modes (such as voice and gestures), allowing drivers and passengers to have a "dialogue" that feels natural with the vehicle and that enables them to receive proactive recommendations on services and functions. At the top of the scale, level five, the system becomes a "virtual chauffeur"—cognitive AI performs highly complex communication and coordination tasks, enabling it to anticipate needs and fulfill complicated, unplanned tasks for the riders.

## Connectivity today—and tomorrow

About four out of five of vehicles on the road today are at or below level one of the C<sup>3</sup>X framework. This demonstrates significant space for improvements. Many vehicles in the premium segment, such as the Audi Q7, BMW 7 Series, Cadillac Escalade, Lexus LX, Mercedes-Benz GLE, and Tesla Model X, to name a few, already meet the criteria for level two, delivering a compelling connected in-vehicle experience to consumers. Currently, no commercialized vehicles meet full level-three capabilities as a standard offering yet, though some models have these features in select trims only. Our research shows, however, that by 2030, nearly half of new vehicles sold worldwide could be at level three or higher.

A common standard for connected-car user experience would go a long way toward enabling that reality. The C<sup>3</sup>X framework allows disparate players across industries to speak the same language, brings clarity to complexity, and sets clear markers for what comes next: a seamless, connected, and intelligent in-vehicle experience. Now, consumers and ecosystem players alike can share a common understanding of exactly what that means. 

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