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INSIGHT: The Developing Landscape of Internet of Things Standards for Cars

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The following is the first in a series of five articles written by WilmerHale lawyers discussing how the emergence of IoT technologies will impact the automotive industry.

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The Internet of Things (IoT) refers to the connection of a multitude of devices through the Internet to collect and exchange data. One area of particular promise for the IoT is cars. Exchanges of data between cars on a street, between cars and pedestrians crossing the street, between cars and traffic lights on the street, and between cars and the Internet could improve safety, reduce traffic, save fuel, and make for a more entertaining drive. For example, a car could be alerted to break quickly because a pedestrian is unexpectedly crossing the road ahead and simultaneously signal to the cars behind it that it is doing so, thereby avoiding a collision. Or a network of traffic lights could be directed to work in cooperation to smooth out the flow of cars in a city and reduce rush-hour congestion. But for these possibilities and others to be realized, cars, pedestrians, and traffic lights each must be able to communicate with one another. Today that possibility has not yet been fully realized. To achieve it, common standards for how those communications will be made are necessary.

This article surveys the status of efforts to develop IoT standards for cars, addressing the progress that has been made to date and the work that remains to realize the possibilities for connected cars.

The Role of Standards

Standards are ubiquitous and shape the world around us by creating common platforms that allow interoperability of products and services no matter who makes or provides them. Electrical plugs and outlets are an example of the role of standards: consumers can trust they can plug an appliance into any outlet in the country. Standards also govern the digital world, including, for example, the operation of cellular networks and communications using Wi-Fi or Bluetooth.

Standards can be formally set by a standard-setting organization (SSO) or can evolve as de facto standards through industry or consumer choice. An example of a formal standard is the 4G cellular standard Long Term Evolution (LTE) developed by the 3rd Generation Partnership Project (3GPP), a global umbrella organization composed of regional SSOs. Adobe's Personal Document Format or PDF is an example of the emergence of a de facto standard for printable documents (that was later formally standardized).

For cars, the widespread adoption of a standard to allow communications between them is particularly important. The potential benefits of IoT applications—particularly those aimed at improving safety—will not be realized fully if all cars on the road are speaking different languages.

How a standard is developed can have significant legal implications. Standardized technology is often covered by patents and the manner in which that technology may be used, licensed, or litigated can be shaped by how the standard originated. For example, licensing of patents for a standard that emerges from an SSO will usually be governed by the SSO's intellectual property rights policy. Licensing and litigation issues will be addressed in greater depth in a later article in this series.

Vehicle to Everything Communications

A fundamental standard for connected cars will address how a car connects to the world around it. This type of connectivity is commonly referred to as ''vehicle to everything'' or V2X. The ''everything'' refers to a range of connections made by the car: vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), vehicle-to-pedestrian (V2P), and vehicle-to-network (V2N) connections.

Today there are two leading candidates to be the V2X standard: (1) Direct Short Range Communication (DSRC) based on the 802.11p standard and (2) and the Cellular-V2X (C-V2X) standard.

DSRC is a two-way radio service based on modifying the 802.11 standard for Wi-Fi into the 802.11p standard that is optimized for operation in a dynamic environment. 802.11p was standardized by the Institute of Electrical and Electronics Engineers. DSRC is intended to allow the transmission of basic safety messages (BSM) between cars and between a car and infrastructure. A BSM can convey information about a car such as its speed, direction, and that it is braking.

Until recently, DSRC appeared destined to emerge as the standard for V2X communications in the United States. In 1999, the Federal Communications Commission allocated the 5.9 GHz band of wireless spectrum for Intelligent Transportation Systems using DSRC. In a 2015 report to Congress, the Department of Transportation reported on progress developing DSRC, concluding that no other wireless technology had yet emerged to rival DSRC. In 2017, the National Highway Traffic Safety Administration (NHTSA) issued a Notice of Proposed Rule Making (NPRM) to mandate that new light vehicles be equipped with V2V capability. In particular, the NHTSA provided V2V performance requirements predicated on the assumption that DSRC would be deployed but allowed for the use of other technologies that could offer comparable performance and interoperate with DSRC.

Proponents of DSRC emphasize its long track record of testing and its endorsement by regulators as proof of its reliability and suitability as a V2X standard ready for immediate widespread deployment. They also argue that DSRC may result in lower cost of implementation than C-V2X if the latter involves recurring fees paid to cellular network operators.

C-V2X was developed by 3GPP based on the LTE standard and was introduced in 2016 as part of 3GPP Release 14. Although C-V2X can operate using a cellular network, it can also provide direct V2V/V2I/V2P communications that do not require a cellular network.

C-V2X has emerged as a significant challenger to DSRC with the backing of a wide array of automotive and technology companies as well as cellular network operators. For example, the Next Generation Mobile Alliance, a group representing network operators, responded to the NHTSA's NPRM to present its view that C-V2X may offer technical advantages over DSRC. Likewise, the 5G Automotive Association, an organization of automotive and technology companies as well as network operators, submitted comments to the NHTSA in which it described its view of the benefits of C-V2X over DSRC.

Proponents of C-V2X contend that it offers improved performance over DSRC, including longer range of operation and improved efficiency by using a cellular network to provide system-wide organization that is lacking in DSRC. In addition, C-V2X backers argue that it will be a lower-cost implementation than DSRC because, by relying on existing cellular infrastructure, there will be no need to incur the cost of deploying DSRC-specific infrastructure on roads. Further, because C-V2X can operate over a cellular network, proponents contend that C-V2X provides greater development possibilities than the older DSRC standard. In particular, with the advent of 5G technology, C-V2X will be able to take advantage of increased throughput and lower latency to support advanced applications like autonomous driving and multimedia services.

Although DSRC and C-V2X use the same spectrum, they are not interoperable. The lack of interoperability means that a choice will have to be made about which standard is the right path forward for V2X.

In-Vehicle Infotainment

Another significant feature of connected cars is the means by which drivers and passengers interact with a car. Hardware- and software-based systems with user interfaces, such as touchscreens displaying navigation, radio, streaming music, and vehicle diagnostics, are often called ''infotainment systems.'' As V2X becomes more prevalent and cars become more autonomous, the infotainment system may begin to replace the steering wheel and pedals as the main control center for the car.

Individual automobile manufacturers have generally developed or licensed proprietary or closed infotainment systems. These systems can be limited in their ability to interact with other types of devices, and there may be little incentive for developers to create applications for specific automobile manufactures if those applications cannot be broadly used with infotainment systems in other cars. These are some reasons why there has been a push toward developing a standard platform for automotive infotainment systems that would allow different software and technology companies to develop products that can be used in any connected car, regardless of the car manufacturer.

One example of an organization developing an open standard for infotainment systems is the GENIVI Alliance, which is working on a Linux-based software platform called the GENIVI Platform. The GENIVI Platform is intended to allow different companies to develop software to run on a single platform by standardizing lower-level software using open source components to which companies can add on their proprietary software to create customized products. In this way, the GENIVI Platform could lead to increased choice for developers of various aspects of the infotainment system, e.g., different companies could provide navigation, or different streaming audio services. An open source standardized infotainment platform can also speed up development time and lower barriers to entry for infotainment system and app developers.

Other organizations are also developing standardized platforms for in-vehicle infotainment systems, including, for example, Automotive Grade Linux (AGL) developed by the Working Group of the Linux Foundation. Similar to the GENIVI Platform, AGL allows developers to build applications on top of a standardized base layer of code. Another group developing a similar platform is the Open Automotive Alliance, an alliance of technology and automobile companies, working on an Android platform for cars.

Though automakers have begun to implement open source infotainment systems in cars, there is not yet a consensus as to which platform will become the leader going forward.

Broader IoT Communication Standards

Beyond the automotive industry, there is a broader IoT landscape in which many organizations are developing communication standards for IoT. For example, the Open Connectivity Foundation seeks to further the development of communications between IoT devices such as smartphones, watches, cameras, and automobiles so that devices can seamlessly communicate regardless of type of device, manufacturer, or operating system.

Other organizations are also working on IoT standards that may have applicability for cars. For example, the Zigbee standard is a proprietary standard that offers specifications for short-range communication between devices. LoRaWAN is another proprietary open standard that is designed for wider range communications, and LTE-M is a cellular-based standard for machine to machine (M2M) communication. Short-range communication standards may be useful to connect personal devices such as smartphones to the vehicle, whereas wider-range communication standards may be useful for communicating information about the vehicle externally, such as vehicle diagnostics or a notification that there has been a collision.

As with V2X and the development of a standard for infotainment systems, work remains to be done to determine the path forward for broadly adopted IoT communication standards.

Stay tuned for the next article in the WilmerHale series: "Internet of Vehicles Technologies as Viable Patentable Subject Matter Within the Alice *Framework*."

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