

19 January, 2021 · 7 mins read

DSRC vs. C-V2X: A Detailed Comparison of the 2 Types of V2X Technologies

A Beginner's Guide to V2X

V2X (vehicle-to-everything) is an umbrella term that is used to refer to a vehicle's communication with all other entities, including other moving and parked vehicles, pedestrians, traffic signals, road signs, construction sites, and many more. A vehicle communicates with the outside world in two ways: 1) by receiving physical feedback from the lidar sensors equipped around the vehicle, and 2) by wireless communication that sends and receives messages to and from other entities. These two methods complement each other to complete the autonomous driving experience. For example, lidar sensors provide feedback from the surrounding environment to detect any immediate threats, while messages regarding every vehicle's location, speed, and direction from as far as 300 meters can be obtained through wireless communication so that the car can adjust its behaviors far ahead of time.

Lidar sensors provide one-way communication, in which the car receives information from its surroundings by physically illuminating them with laser light. By contrast, wireless communication technology enables two-way communication, so that the vehicle not only receives information, but also sends messages regarding its behavior to all other certified entities. Today, the term "V2X" is mostly used to refer to the latter – wireless vehicular communications.

V2X technology significantly increases a vehicle's autonomy. For instance, by communicating with traffic signals, the car receives real-time information about when to stop at intersections. By communicating with the pedestrians' mobile devices, the car can stay ahead of itself to prepare to stop for jaywalkers. By communicating with construction and accident sites, the car can look for the nearest detour to avoid getting trapped in traffic jams.

Note that V2X must be complemented by lidar sensors because even though it provides perfectly accurate information, it is not capable of detecting entities that are not equipped with communication technology, such as an old conventional car or a rock on the road. Thus, the importance of cameras and sensors must not be neglected.

In this post, we will take a deeper look at the two different V2X wireless communication technologies currently used by automakers and infrastructure developers across the globe.

DSRC (defined by IEEE 802.11p: WAVE)

DSRC was first introduced as a V2X technology in the Institute of Electrical and Electronics Engineers (IEEE)'s 802.11p standard, a vehicular communication protocol intended for adding **wireless access in vehicular environments (WAVE)**. As the first communication standard for V2X, WAVE uses **WLAN technology** to establish dedicated short-range communication (DSRC) channels so that the vehicles can communicate directly to other entities within **short to medium ranges (typically 300 meters)**. Despite WAVE being the official name of the protocol, many still refer to the technology as DSRC to describe the underlying mechanism. In fact, many industry experts would use the terms **DSRC, 802.11p, WAVE**, or **WLAN-based V2X** interchangeably to refer to the same thing.

DSRC is essentially a modification of Wi-Fi. The technology was considered a huge breakthrough in the automotive industry because it allows for data to be transmitted between two devices without going through any intermediaries, making it highly useful for rural and remote areas without any telecommunication infrastructure. This is like sending a text message to another phone 300 meters away without the need for cellular network coverage. Moreover, DSRC is known for having very low latency due to the elimination of the intermediary.

After its initial approval in 2010, DSRC went through years of testing before it was first deployed in selected Toyota vehicles manufactured in Japan in 2015, and later adopted by some Cadillac models in the US in 2017. In 2019, the Volkswagen Golf 8, one of the most popular cars in Europe, became the most sold V2X-enabled car in the market.

C-V2X (defined by 3GPP Releases 14, 15, 16)

Introduced soon after DSRC, C-V2X is another vehicular communication protocol developed for V2X. Defined by the 3rd Generation Partnership Projects (3GPP), C-V2X utilizes cellular radio instead of WLAN, meaning that it utilizes the same set of cellular radio technology as cellphones do. The major difference that sets C-V2X apart from DSRC is that it allows both **direct and indirect communication**. In **direct C-V2X**, vehicles communicate directly with other vehicles (V2V) and roadside units (V2I) the same way as how DSRC works. Under indirect C-V2X, vehicles communicate with other entities indirectly **via the cellular network** (V2N), which is something DSRC cannot do.

Indirect C-V2X is useful because the cellular network can collect data from many cars, and thus can be more effective at managing traffic on a larger scale. Originally designed in Release 14 to use the LTE standard, 3GPP later added compatibility for 5G and 5G NR in Releases 15 and 16.

Even though **DSRC** had been gaining ground in **Japan and Europe**, **C-V2X** is becoming increasingly popular in the **US, China, and other regions** of the world. Furthermore, C-V2X has won support from many professional organizations such as the **5G Automotive Association (5GAA)** based on its advantages to DSRC. Then, what are some of the pros and cons of C-V2X when compared to DSRC?

On the pros, supporters of C-V2X generally suggest that cellular radio technology has better growth potential for faster speeds and higher reliability. This means that looking at the long-run, C-V2X is more sustainable as it offers a long-term path for constant improvements. Moreover, the ability to connect to the cellular network could create a much smarter transportation system. Lastly, the price of cellular chipsets is cheaper than that of WLAN

chipsets.

On a side note, some uncontrolled experiments show that direct C-V2X offers greater range than DSRC. But this is not scientifically proven, and that the 300-meter range of DSRC is more than enough for autonomous driving purposes.

As for the cons, supporters of DSRC believe that switching to C-V2X would delay the rollout of autonomous driving because DSRC is a more mature standard, proven to work in large commercial settings. C-V2X is still undergoing its final testing stage when it comes to large-scale deployment, and indirect C-V2X does not look like it will be ready for commercialization until at least 2024, though direct C-V2X is on schedule for commercial deployment in 2021.

DSRC and C-V2X Compatibility

At the end of the day, both DSRC and C-V2X have the same use cases, meaning that the real-life application is the same across both standards. Despite all the rhetoric from both sides, there had been no side-by-side testing proving that one performs better than the other in application.

Due to a lack of statistical evidence on the performance side, the industry has slowly shifted to prefer C-V2X as it exhibits better long-term prospects. The problem is that because DSRC and C-V2X run on different communication technologies, the access layer is not interoperable. Automakers and infrastructure developers face the difficult choice of adopting one or the other in their infrastructures.

The good news for automakers is that many chipmakers have started manufacturing dual-mode chipsets that are compatible with both standards, helping those undergoing the transition.

In terms of infrastructure developers, many of those with existing DSRC infrastructures are now working to add cellular network connectivity to them by combining them with indirect C-V2X.

	DSRC	C-V2X	
Protocol Name:	IEEE 802.11p: WAVE	3GPP Releases 14 and above	
Communication Technology:	WLAN	Cellular (LTE, 5G, 5G NR)	
		Direct C-V2X	Indirect C-V2X
Time of Deployment:	2015	2021	2024
Cellular Network Connectivity:	No	No	Yes



The Role of Cybersecurity in V2X

Regardless of the communication technologies used, cybersecurity is an integral component of V2X. AutoCrypt V2X is a security solution that embeds itself in V2X chipsets, protecting the V2X system with both authentication and data encryption technologies. It ensures data integrity by verifying every entity to ensure they are who they claim to be, and protects sensitive information by encrypting the messages in transmission. Working with

chipmakers around the world, [AutoCrypt V2X](#) is currently active in a number of C-ITS projects and is major supplier for some of the world’s largest automakers.

To keep informed with the latest news on mobility tech and automotive cybersecurity, [subscribe](#) to AUTOCRYPT’s monthly newsletter.

Share This Article

Related Articles



Who Might Launch Cyberattacks on Connected Cars and Why?

11 March, 2022



Top 4 Car Features That Rely on Vehicle-to-Cloud Connectivity

16 February, 2022



Infographic: Potential Cyberattacks in Connected Cars and Mobility

24 January, 2022

Interested in what we do?Let’s see how we can work together.

Contact Us