Lingua Vehiculum: The competition for connected car communication

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The safe and efficient operation of connected and autonomous vehicles (“CAVs”) depends on CAVs communicating with various systems and actors. This issue provides an overview of the two leading connected vehicle communication technologies: DSRC and 5G C-V2X, along with jurisdictional highlights on these technologies from the European Union, the United States, China, and Canada.

Background

CAVs need to communicate with:

- Vehicles (Vehicle to Vehicle communication, “V2V”);
- Infrastructure (Vehicle to Infrastructure communication, “V2I”);
- Pedestrians (Vehicle to Pedestrian communication, “V2P”);
- Networks (Vehicle to Network communication, “V2N”);
- Devices (Vehicle to Device communication, “V2D”);

To make things simpler, we can use Vehicle to Everything communication (“V2X”) as an all encompassing term that captures the aforementioned V2V, V2I, V2P, V2N, V2D and all other CAVs communication.

All this communication means that CAVs produce enormous and increasing amounts of data. To put this in perspective, consider that in a single day, CAVs currently being tested produce as much data as the Hubble Telescope produces in a full year.

Rapid and reliable V2X communication is the key technology required to facilitate the deployment of Level 4 and 5 CAVs. Under the Canada–U.S. Regulatory Cooperation Council’s Connected Vehicles Work-Plan, Transport Canada and the U.S. Department of Transportation will “coordinate and collaborate” on vehicle communication technology.

Given the key role communication technology will play in the CAVs market, there is serious competition amongst automakers, tech companies and regulators in search of the V2X communication protocol that can unlock the full potential of CAVs.

Today, there are two main V2X technologies in competition:

1. Dedicated Short Range Communication ("DSRC")

In 1999, the American Federal Communications Commission (FCC) allocated 75 MHz in the 5.9 GHz ITS Band (5850-5925 Mhz) for DSRC service in the Intelligent Transportation System ("ITS") radio service. DSRC is also known as ITS-G5 and/or 802.11p. Consequently, DSRC has been the dominant protocol recommended for connected vehicle communication. On December 13, 2016, the National Highway Transportation Safety Administration ("**NHTSA**") proposed a new rule (Federal Motor Vehicle Safety Standard ["**FMVSS**"] 150) to mandate DSRC communication on light vehicles, enabling new crash-avoidance applications that could prevent hundreds of thousands of crashes every year by helping vehicles "talk" to each other.

DSRC would require investment (likely public) to install and maintain significant infrastructure to support the technology – estimates for the cost of deploying a complete DSRC system in the United States run as high as $108 billion (USD). DSRC supports the broadcast of precise anonymized vehicle information several times per second, including location, speed and acceleration. This information can be used by other DSRC-enabled vehicles and devices to help drivers prevent collisions. Communication can also be enabled to provide helpful real-time information to drivers, such as potential hazards, slow or stopped vehicles ahead, or signals, signs, and road conditions that may be difficult to see.

As noted, DSRC communicates using seven channels of the 5.9 GHz spectrum band allocated for ITS in the United States and many other jurisdictions. Because the technology does not require a cellular or data network, vehicles equipped with DSRC do not incur any cellular network carrier charges.

DSRC's primary advantage and disadvantage come from the same fact: it is an established and tested V2X technology. DSRC has been deployed in vehicles in North America, Europe and Japan and is, or has been, the preferred vehicle communication technology of some of the largest vehicle manufacturers in the world. It has been described by Toyota as a "proven technology" that has been "out of the testing and conceptual phases for some time". DSRC, however, now uses a ten-year-old standard (IEEE 802.11p), provides comparatively limited functionality and is a single purpose technology only useful in V2X communication.

2. 5G

An alternative vehicle communication protocol running on existing 3G and 4G networks is known as Cellular V2X ("**C-V2X**"). This technology becomes a complete game changer in combination with new 5G mobile networks ("**5G C-V2X**") – an increasingly available standard, as countries rush to roll out 5G networks.

Proponents of 5G C-V2X argue that the technology's capacity to provide gigabytes per second data rates, high speed mobility support, massive machine communication and ultra-low latency communication give it a categorical advantage over DSRC and would provide the needed technological basis for the deployment of more highly automated CAVs. Importantly, unlike DSRC, both current V2X and future 5G C-V2X could rely on private cellular infrastructure, thus limiting public infrastructure spending to roll out a

V2X system. 5G C-V2X has the benefit of using up-to-date technology, relying on already widely distributed multi-purpose cellular technology and offering a broader range of applications. C-V2X is continually evolving and relatively untested when compared to the more established DSRC. Further development and testing of 5G C-V2X is required to better assess the performance of the technology in real-world application. Moreover, it remains to be seen if sufficiently widely distributed and dense 5G networks will make the adoption of 5G C-V2X practicable in all markets.

United States

The U.S. NHTSA is responsible for drafting and enforcing FMVSS and plays a central regulatory role in producing federal guidance for automated vehicles. Having issued the "Federal Automated Vehicles Policy" on September 20, 2016 and "A Vision for Safety 2.0." on September 12, 2017, the NHTSA's most recently published guidance is "Preparing for the Future of Transportation: Automated Vehicles 3.0.".

Under the current administration, the United States can be seen to have shifted from endorsing DSRC for V2X communications to a position of technological neutrality. Technological neutrality means that the NHTSA has taken a step back and will permit market forces to determine which V2X communication protocols are introduced.

In the American market, C-V2X appears to have seized the momentum. At the 2019 Consumer Electronics Show, Ford announced it was planning to introduce C-V2X into its vehicles in North America in 2022. While there has been some indication of a shift by automakers away from the previous commitment to DSRC, it now appears that there is a general congruence of preference toward C-V2X and in some cases, a dual commitment to both technologies.

European Union

In July 2019, the European Union officially rejected the European Commission's recommendation to use DSRC (known in Europe as Cooperative Intelligent Transportation System or C-ITS) technology as a V2X communications protocol. This represents a significant shift as for roughly the last decade, there was an apparent preference in this jurisdiction toward DSRC V2X communication technology. This policy decision was welcomed by stakeholders as it was viewed by some to provide much needed clarity regarding future development of V2X technology and greater alignment with policy in the United States and China. Again, as in the United States, the momentum seems to be with C-V2X in Europe.

China

In China, C-V2X has been favoured as the sole vehicle communication protocol. China's dedicated adoption of C-V2X, large vehicle market and leading CAVs companies might be enough to secure the adoption of C-V2X on a global scale. China is now the world's largest vehicle market, with 29 million cars and trucks sold in 2017, making Chinese standards very influential in global vehicle manufacturing. Chinese automotive companies, for their part, are pushing ahead with C-V2X: in February 2019,

Chinese automaker Zhejiang Geely Holding Group announced a major partnership to put its first 5G C-V2X enabled vehicles into mass production by 2021.

Conclusion

The Canadian government has endorsed neither DSRC nor C-V2X. Given the clear momentum in favour of C-V2X in leading markets and regulatory alignment with the United States, there appears to be a growing momentum for C-V2X in Canada as well.

While 5G C-V2X appears to have the advantage in key jurisdictions, it remains relatively untested compared to DSRC and key questions of cost, infrastructure and timing remain. How would the deployment of DSRC or 5G technology look outside of a densely populated and/or technologically advanced market? Also, there are critical questions about the security and vulnerability of DSRC and 5G that may prove determinative. These, and other questions, will be the subject of intense debate as automakers, tech companies, and regulators consider the path forward for V2X communication.

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