

Why Vehicle-to-Everything (V2X) Is the “X” We Should all Be Aiming for

Introduction

“The future is now.” It’s a phrase we’ve heard often but has never been truer for those of us in the Intelligent Transportation Systems (ITS) industry. Businesses are on a quest to improve safety, sustainability, and operational efficiency for those we serve - road users, product and platform subscribers, city and state governments, and more. Our technologies impact millions (if not billions) of people per year. With this immense reach comes great responsibility. We must act today to create the technologies that utilize the safest, latest, and best forms of communication to deliver on our mission to continuously improve safety and sustainability in our world.

The rapid pace of technological development and digital transformation in the industry isn’t enough for many. Regulatory challenges, dated deployment practices, and a disparate network of products and solutions are causing the adoption of new technologies to be slow and battered down. If we do not act quickly, our prospects of a smart and connected future are at risk. ITS service providers must work together to create new and better practices to ensure we deliver on our promise for a safer, greener tomorrow.

So, what is the key to winning and delivering on our promise of sustainability and safety? At Global Traffic Technologies, we believe it means utilizing a vehicle-to-everything (V2X) communications network. V2X is a standard of bi-directional data communication allowing vehicles to “speak” to the world around them. A critical part of that world is roadway infrastructure – traffic controllers, detection solutions, tolling devices, innovative hardware platforms, and more. The vehicle’s ability to speak an infrastructure’s IoT network is critical for the full and mass adoption of the V2X standard.

In this paper, we will briefly explore the technology behind V2X communications, the challenges ahead, and how we play a role in ensuring we deliver on our mission to improve safety, sustainability, and operational efficiency in our industry.



The challenge

As early as 1999, the Federal Communications Commission (FCC) allocated the spectrum around 5.9 GHz for use in V2X applications. But despite the investment in technological development in the auto and ITS industries, full adoption, and deployment of the V2X standard (specifically the C-V2X, Cellular Vehicle-to-Everything standard) has not happened. In August of 2022, the FCC reallocated more than 50% of the spectrum for use in other bids. 30 MHz remains, but if we don't act now, the risk of losing the V2X standard communications for integrated roadway technology is at risk.

What is V2X?

Vehicle-to-Everything (V2X) is a term for standard communication between vehicles and the Internet of Things (IoT) using wireless technology. Sensors and devices on board vehicles enabled with V2X technology communicate to the infrastructure, networks, other vehicles, and even vulnerable road users (pedestrians, cyclists, and micro-mobility users) around them.

When thinking about the interconnectivity of cars, infrastructure, and people, the complexities can become overwhelming. Let's think of it as the development of email communication. In its infancy, it was like a physical mailbox, where someone could leave a message on a computer, and the next day, someone else could come in and check the message on that computer. Sounds cumbersome, right? Well, in 1965, when MIT was experimenting with email, there was no network of connectivity.

The critical component for email to become effective was broad adoption. That adoption required 4 key steps:

1. A network of communication
2. Clear use cases
3. Inclusive access at low to no cost
4. Widespread awareness

Fast forward to 2022, and email is one of the most widely used standards of communication for people around the world. Like any significant innovation, it developed over time and evolved with every iteration.¹ As seen with email, mass adoption is critical to the success of the V2X because, without the majority of vehicles and roadway infrastructure utilizing it, the benefits and uses are minimal. So how do we apply the email case study to V2X?



A network of communication

We can check this one off the list – for now. The FCC has allocated the radio communication spectrum, and IEE and SAE have developed the communication standards, so our network is well-defined. But as discussed above, the bandwidth is limited. The faster we move, the more likely we are to secure our stakes.

Clear use cases of V2X

The best way to break this down is by outlining the various forms of V2X as seen below.



Vehicle-to-Infrastructure (V2I) technology connects vehicles to everything from traffic signals to roadway signage. When signals communicate their status directly to vehicles, they can better plan their speed as they approach. Conversely, signals can be timed to give priority to certain vehicles based on classification and mode. Studies show that this capability improves traffic flow and safety and can reduce emissions by as much as 15% when widely deployed.



Vehicle-to-Vehicle (V2V) enables all forms of vehicles to communicate directly with each other to share and collaborate on traffic conditions, road issues and other forms of hazards and delays. Vehicles can also transmit information about their speed, direction, location, braking, turning intent and more. This communication allows vehicles to make safety decisions reducing crash rates and improving road user safety.



Vehicle-to-Network (V2N) technology transmits information between vehicles and network management systems. This process is made possible through high-bandwidth, low-latency, high-reliability network infrastructure. Cars can receive broadcast alerts about traffic congestion or accidents further down the road, paving the way for autonomous driving and improved mobility.



Vehicle-to-Pedestrian technology enables direct communication between a vehicle and a pedestrian within proximity. Pedestrians use a smartphone application for bi-directional communication. Vulnerable road users get audio alerts when emergency vehicles are approaching and reminders of how to react to roadway conditions.

There are use cases far beyond what is highlighted above that will improve the lives of road users. Uses such as road user charging, a topic that is top of mind as we move from gas-powered vehicles to electric vehicles. Like email, applications are continually being developed; the only limits are our imaginations. ²

How it works



If the bus is behind schedule, a TSP request for a longer green or shorter red light is sent to the intersection.

Schedule Status	Minutes
LATE	3

If the bus is on time, no TSP request is made.

Schedule Status	Minutes
ON-TIME	0

Vulnerable road users get alerts when emergency vehicles are approaching.

Route schedule and vehicle updates can be performed remotely while vehicles are in the yard.

Public works vehicles can move continuously through corridors to complete work more efficiently.

Law enforcement vehicles can be given priority based on incident type aligned to rules defined by each municipality.

Freight vehicles can be assigned priority levels that allow them to move safely while reducing congestion.

Agencies can choose to have redundant IR, radio and/or cellular communications.

Existing Opticom IR and Radio systems can coexist while migrating to the Opticom C-V2X Solution.

Data from vehicles relays the status, response mode, geographic location, and more to an intersection.

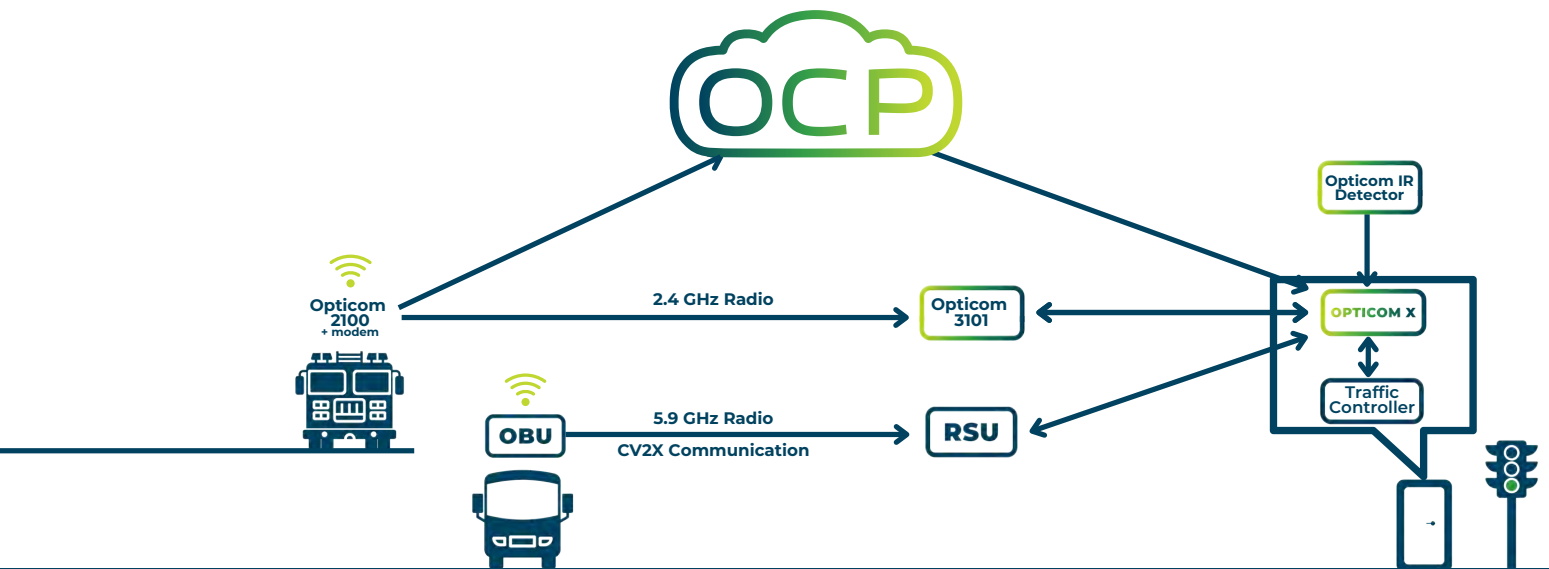


Figure 1 The Opticom X Processor is backward compatible. It can work with existing Opticom infrared detection systems as well as communicate using 5.9GHz, C-V2X communication, and third party RSU's and OBU's.

Spread the word

We all understand that V2X is the standard of communication between vehicles and the world around them. The complex architecture required for vehicles to communicate with intersections has been deployed for years via Emergency Vehicle Preemption (EVP) and Transit Signal Priority (TSP), collectively known as Priority Control. By migrating priority control solutions to the C-V2X standard, we can sustain our critical network communications on the dedicated 5.9GHz radio spectrum.

Technical Engineers and product specialists at GTT are actively demonstrating proof of concept for priority control enabled with C-V2X communication. In a matter of months, there will be active pilots in cities around the US. Within a year the idea of C-V2X comms at the intersection

will be a reality. The new "Opticom X" processor will support infrared and GPS priority control while also allowing cities to be armed with C-V2X enabled hardware at the traffic cabinet. Backwards compatibility makes Opticom X accessible to a broad base of customers. When cities are ready to fully invest, Opticom will be there to support them.

C-V2X is the future. It will enable safety, sustainability, and better business operations, but only if deployed widely. GTT is acting with increased velocity to bring this solution to market and make it accessible and affordable, but it is up to you to help spread the word.

Will you support the future of connectivity by being a V2X champion?

Inclusive access at low cost

Flexibility is key. No two customers are the same. While businesses seek to standardize processes and pricing models, they must remember that each unique customer wants a solution that fits their individual needs. This is achievable if we build V2X platforms with open standards that adhere to the most up-to-date security best practices, always keeping the customers' needs at the forefront of development.

The Opticom solution has been sold for nearly six decades. The approach is consultative and focuses on building strong relationships with our customers. We understand the uniqueness of each community and strive to provide the best service at the best cost. Customers range from small towns with only a few signalized intersections to the largest megacities in North America. Because of our tenured, field-proven experience, we can provide holistic solutions for agencies of any size. This makes Opticom widely accessible.

Opticom priority control is V2X; it is a form of data communication. In this case, data from the vehicle relays the status, response mode, geographic location, and more to a data processor. That processing computer then sends a message to the traffic controller to ensure signals provide safe, timely, and efficient passage of emergency vehicles, buses, and fleet vehicles. The results are improved response times and roadway safety, a significant reduction in CO² emissions by fleets

and public transit services, and improved business operations for platform users.

Historically, Priority Control was enabled through line-of-sight hardware such as infrared and focused on serving the public safety segment. As technology has progressed, we've migrated to GPS solutions and are now cloud-connected, meaning we can make priority control requests and pull in data from other connected devices to better inform decision-making. With these innovations, the vehicle receives the benefits of priority control and C-V2X enablement with approved, connected data communication devices. This advancement opens a vast network of big data and allows for new use cases far beyond EVP and TSP.

For nearly sixty years, Opticom Priority Control has been the trusted leader in emergency vehicle preemption (EVP) and transit signal priority (TSP). **There are over 180,000 Opticom devices at intersections and vehicles worldwide.**

Leveraging that install base and enabling a new suite of hardware with backward compatibility that uses the C-V2X standard of communication is the fastest and most accessible way to deploy V2X broadly. This will allow the ITS industry and automakers to maintain bandwidth on the spectrum and to deliver on the promise of safety and sustainability.

“...the fastest and most accessible way to deploy V2X broadly.”

Conclusion

The National Highway Transportation Safety Administration estimates that 9,560 people died in motor vehicle traffic crashes in the first quarter of 2022, which is a 7% increase over 2021³. In 2021, road fatalities were at a 16-year high⁴. While there are many contributing factors to these metrics, the fact is that technology can improve these statistics. Roadway fatalities do not have to be accepted as inevitable.

When intelligent vehicles can connect to smart infrastructure, fatality rates will decline. Vehicle-to-Everything technology that utilizes the 5.9GHz cellular network is critical to these lifesaving efforts. The various types of V2X deployment include vehicle to infrastructure, vehicle, network, and pedestrian, which all aim to improve communication of roadway devices and users through an IoT network standard. While these complexities of V2X solutions may seem vast, the most significant risk to this technology is the reallocation of the 5.9GHz spectrum to alternative uses. Industry leaders must act quickly to preserve bandwidth for V2X.

In addition to fast action, V2X requires mass adoption. Like email communication, the solution is only effective if many people use it. Global Traffic Technologies has deployed a connectivity network in vehicles and devices for nearly 60 years. Our

newest development, the Opticom X processor, is V2X capable and backward compatible. Opticom X will work with existing Opticom infrared and GPS devices and third-party road-side-units (RSU) and on-board-units (OBUs) using the CV2X communication standard. With this device, quick deployment at a mass scale is possible because preemption is one of the most straightforward use cases for V2X technology, and Opticom devices are in more than 180,000 vehicles and intersections worldwide.

New solutions must be built with flexibility and scalability in mind. Every community has different needs, and timelines for commitment to new technologies differ. Cities that commit will be V2X ready and cloud-connected, preparing their systems for an upgrade when they are prepared for complete migration.

Our goal is to empower the ITS industry to maintain bandwidth on the 5.9GHz spectrum. This will open the doors for many more applications using V2X to save and improve the lives of all road users. The only limit to the possibilities is our imaginations.

The future is now! Will you be a V2X Champion?

Sources

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