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Towards Zero: creating safer roads with cellular-V2X in Australia

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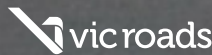
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A vision for safer roads

"Towards Zero" is the Victorian State Government road safety strategy, focused on a future free from deaths on the roads. The strategy includes trialing connected vehicles to improve road safety.

Towards Zero
The only acceptable number of deaths on Victoria's roads is zero. Technology and communications are one way that road authorities envision meeting that goal. James Soo, Safer Vehicles and Future Vehicle Technology Manager at the Victorian Department of Transport (formerly VicRoads), explains that "human error is a significant contributor to road crashes", meaning momentary lapses of concentration or judgment are far more likely to cause accidents than overtly dangerous driving. Because of this, the development of viable Cooperative Intelligent Transport Systems (C-ITS) and emerging vehicle technologies that automate driving processes is an area for strategic investigation in the Towards Zero plan. While fully automated vehicles are still some way in the future, it is important to develop C-ITS components, which will save lives in the nearer term.

A unique collaboration
As part of the Towards Zero Connected and Automated Vehicle Trial Grants Program, Telstra and Lexus Australia were awarded an AUD 3.5 million grant from the Victorian State Government to run a field trial of 4G-based connected vehicle technology. As the network partner for Telstra, Ericsson provided the cellular vehicle-to-everything (C-V2X) platform from which the trials of different use cases were run and Telstra optimized the 4G network for very low latency communications. Lexus Australia, which has previous experience of V2X trials in Australia using dedicated short-range communications technology, provided two Lexus RX 450h SUVs that use Ericsson's C-V2X platform to connect to one another, to traffic management centers with cloud servers, and to the Victorian Department of Transport's real-time traffic data.

This collaboration is unique in many ways — the cross-industry partnership between a government organization, road authorities, communications service provider, network provider and vehicle original equipment manufacturer (OEM) is almost unprecedented, while the trial of C-V2X technology for C-ITS use cases itself represents an Australian first.

> "In the past, in road safety, it's primarily been road engineers, traffic engineers, doctors, behavioral scientists... really dealing with human behavior. The future is all about science. It's about communications."
>
> **Samantha Cockfield, Lead Director of Road Safety, Transport Accident Commission (TAC)**

Human error is the most likely cause of accidents on the road — C-ITS emerging vehicle technologies can reduce these risks

How C-V2X will create safer roads in Australia

These trials demonstrate how the existing cellular
network can be used to increase safety outcomes
on roads now and in the near future.

**Ericsson's C-V2X technology
and platform**
To ensure fast enough response times to
make a difference to safety outcomes, very
low latency is critical for connected vehicle
solutions. To facilitate near-immediate
delivery of data, Ericsson's C-V2X
technology was utilized in conjunction
with an optimized version of 4G
designed by Telstra for use in connected
vehicle technology, rather than for
mobile broadband. A high-performance
quality of service (QoS) link for
Broadband IoT type applications was
created in Telstra's 4G network on
Ericsson 4G cell sites, giving C-V2X
communications very low latency and
high priority. This QoS link is effectively
a precursor to 5G network slicing.

During these trials, the end-to-end
(E2E) latency (i.e. the full journey of data
from the vehicle, through the C-V2X
platform and back to the vehicle) was
under 50ms for 95 percent of trials in a
test area based on Telstra's public 4G
network. Most importantly, the service

<50ms

E2E latencies of less than 50ms
were observed in 95 percent of trials.

delivers consistent latency while servicing
other users, in both city and regional
areas, quite unlike a typical mobile
broadband experience. This will improve
further when the C-V2X platform utilizes
5G and edge compute technologies.

Harnessing the existing cellular network
Previously, C-ITS use cases centered
around short-range communication,
such as direct vehicle-to-vehicle
(V2V) and vehicle-to-infrastructure
(V2I) communication using dedicated
roadside units (RSUs). Ericsson's
C-V2X technology is based on a wide
area network, leveraging existing 4G
in these communications without the
need for deploying additional physical
infrastructure, effectively creating
virtual RSUs. The platform is based on a
standard interface, enabling multi-OEM,
multi-agency implementation. This
revolutionizes the industry's innovation
ecosystem and accelerates the
deployment of road safety solutions,
opening up the potential to explore new
use cases, as well as making the solutions
extremely scalable and economical.

Virtual RSUs have the potential to
make huge impacts on the costs and
time-to-market (TTM) of all these
solutions. Telstra's tried-and-tested 4G
network currently covers 99.2 percent of
the Australian population, meaning that
an Australia-wide rollout over Telstra's
4G network is easy to envision. In short,
deploying any solution over an existing
network offers scalability and TTM
advantages that can't be matched.

"It's very important to be able to use
the cellular network that's already
deployed by the operator. And if we
can create the infrastructure needed
by using the cellular network,
there are of course huge efficiency
gains for the road authorities."

Håkan Eriksson, CTO, Telstra

Leveraging existing cellular networks for C-V2X has
a huge impact on cost, TTM and scalability

Lexus Australia's role included providing the cars for the trials

Successful trials of use cases such as the red light violation warning prove the potential of this technology

Looking forward to 5G

These use cases have been demonstrated using 4G, but all partners are optimistic about the impact 5G will have on connected vehicles and road safety in the future. Telstra's CTO, Håkan Eriksson, said, "We can already do a lot with the 4G network, and 5G will make it even better."

Slicing dedicated channels to carry V2X data will ensure quick delivery of priority messages. This will be critical to eliminating delays and increasing service reliability, even when the network is in heavy use. Similarly, the ability of 5G to carry large amounts of data to multiple sources at once means that it will be possible to "broadcast" one message or warning to a very large number of users simultaneously. The solution can be further enhanced as 5G URLLC (Ultra-Reliable Low-Latency Communication) and edge compute technology are rolled out, allowing for highly automated vehicles and increasingly sophisticated C-ITS applications to be supported.

Unique life-saving use cases

A key requirement of the trial is very low latency. With a high-performance QoS link and Ericsson's C-V2X platform, a number of unique C-ITS use cases were successfully tested and demonstrated over Telstra's public network, with near real-time responses (about 30–50ms) achieved.

Slow/stopped vehicle warning:
Vehicles that are broken down or traveling slowly send out an alert to warn other drivers of their potentially hazardous position, including around corners or behind obstacles where hazard lights aren't visible.

In-vehicle speed advisory:
Information from the road authority regarding speed limits, including variable or recently changed limits, is communicated to the vehicle based on its location.

Red light violation warning:
Vehicles approaching intersections receive data about the timing of traffic lights, and drivers nearby are warned if the speed of a nearby vehicle indicates that they are likely to run a red light.

Emergency electronic brake light:
When a leading vehicle brakes suddenly, an alert is triggered to warn surrounding cars traveling in the same direction. This alert is delivered before forward collision radars and other sensors would be able to detect the hazard.

Right turn assist/pedestrian warning:
The road infrastructure communicates the presence of crossing pedestrians or bicycles at an upcoming intersection to the vehicles using the C-V2X platform, to alert the driver before the road users are visible.

The future of connected vehicles

In the future, C-ITS communication over a C-V2X platform will be commonplace, first using 4G and then 5G.

Transforming the automotive industry
Just as advanced safety features such as on-board parking cameras and collision radars have become more widespread as vehicle fleets are replaced globally, this technology is predicted to gradually become commonplace, and even expected, in the near future.

Virtual RSUs and the C-V2X platform use standard application programming interfaces, messaging and protocols, meaning that automotive OEMs can begin including the technology in their fleets sooner rather than later and scale it as the technology develops, including during the switch to 5G. The solution offers flexibility for OEMs and road authorities to decide on the road safety applications that they would like to deploy over time.

Successful trials using 4G open up the possibility to test a range of applications and explore new use cases that are only theoretical at the moment, but become more likely the closer we get to a 5G future. C-ITS could have a range of benefits beyond safety, such as greener cities and increased convenience for drivers. For example, Håkan Eriksson predicts a time that very heavy vehicles could eventually "negotiate" with the infrastructure of the road by requesting that a traffic light stay green for a few extra seconds to avoid them having to waste fuel. The environmental benefits are also predicted by Vesna Benns at Lexus Australia, as improved traffic flow will make journeys shorter and more economical. By increasing the amount of processes that are autonomous, these use cases could even represent a significant step towards driverless cars.

Safer roads for everyone
The potential of this technology to improve road safety outcomes is recognized by the Victorian State Government and the TAC, as it helps to address the cause of most road accidents — human error. There is a limit to what can be achieved by trying to influence human behavior and create safe infrastructure, and that's where automated processes that use communications technology can make a real difference.

> "What we really see here is the opportunity to make a change in safety outcomes by getting information to drivers in milliseconds that they otherwise would not have received, so that we can get people home safely."
>
> **Vesna Benns, Corporate Manager — Advanced Planning Group, Lexus Australia**

The connected cities of the future will be made greener, safer and more convenient through the use of cellular IoT

Ericsson enables communications service providers to capture the full value of connectivity. The company's portfolio spans Networks, Digital Services, Managed Services, and Emerging Business and is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's investments in innovation have delivered the benefits of telephony and mobile broadband to billions of people around the world. The Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York.

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