Cohda Wireless

SAFER | SMARTER | GREENER

About Us

Societal Costs of Road Transportation

Intelligent transportation systems (ITS) are designed to enable cooperation between vehicles and road infrastructure, using state-of-the-art CAV applications, to achieve improvements in safety, mobility and the environment

Accidents

In Europe, there were over 38K fatalities and 1.7M injuries caused by auto accidents with 93% due to human error

In the US, there were over 35K fatalities and 6.3M accidents in 2015 costing the US over $720B

It is estimated that V2V communications can address 79% of accidents, while V2I communications can address 26% of accidents and, combined, they can address 81% of all accidents

Traffic

In Europe, 1% of GDP is lost to congestion annually

In the US, 6.9B hours are lost annually in traffic with urban congestion costing the US $160B annually

Estimates indicated that connected vehicle dynamic mobility applications can eliminate one third of travel delay caused by congestion and improve freight deliver times by over 20%

Environment

In the US, transportation contributes 56B pounds of carbon dioxide a year

3.1B gallons, or over $6.5B, of fuel are wasted annually due to congestion in the US

ITS could achieve a 2 to 4% reduction in oil consumption and related greenhouse gas emissions each year over the next 10 years

Source: US Department of Transportation

Who is Cohda?

Cohda Wireless is the leading software and sensor supplier for the CAV and Smart City markets with a vision to make driving safer, more enjoyable and with less impact on the environment.

Mission Statement

License innovative, world leading Connected Autonomous Vehicle ("CAV") solutions to Tier 1 automotive suppliers, ITS Equipment Vendors and METS vendors

VEHICLE-TO-VEHICLE	VEHICLE-TO-INFRASTRUCTURE	VEHICLE-TO-PEDESTRIAN	VEHICLE-TO-NETWORK

Cohda in Brief

- Hardware agnostic, leading supplier of software for the CAV market
- An innovative localization product with application to CAVs, underground mining and indoor retail
- Software proven to work on 5G networks, Wi-Fi and DSRC
- Strong patent portfolio with over 54 granted patents and 51 applications under examination
- Proven scalable platform proven to offer more performance in over 100,000 km of testing in live, zero-tolerance conditions
- Over 65% of vehicles in V2X trials use Cohda solutions and it is the only solution currently in production with an OEM
- Working with 600+ customers, including ongoing CAV trials and several Smart City deployments already in place

GM   HYUNDAI   Peloton   RioTinto

SIEMENS   NEW YORK CITY DOT   VW

- Engineering team of 30+ experienced PhDs and engineers

Cohda's Sectors

Cohda has applications across a multitude of markets, but is concentrated on the fastest growing segments of the Autonomous Vehicle and Smart City markets

V2X

Cohda's hardware-agnostic V2X stacks are used in more than 60% of all connected vehicle trials worldwide

Backed by more than 100,000 km of real-world testing

OEM supplier of choice for production vehicles

Selected for the world's first, and second production deployments

CAV

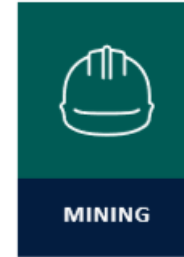Cohda Wireless is a global leader in the mobile outdoor communications

Already solved fundamental communication issues such as CAV localization, sensor fidelity and system cost

Preparing the next generation of CAV application layer software

SMART CITIES

Cohda's Smart City architecture allows cities preparing for a CAV future to leverage the infrastructure already in place enabling an array of applications

Cohda's range of foundation applications can be deployed today and have been shown to provide immediate benefits reducing congestion and improving travel time

MINING

Cohda delivers industry-leading connectivity solutions for the mining industry, improving safety and productivity in challenging environments
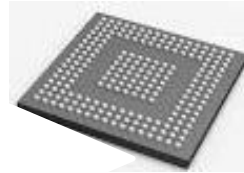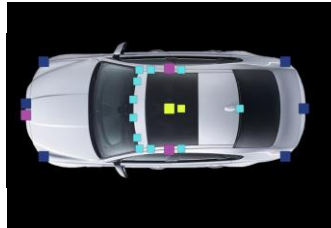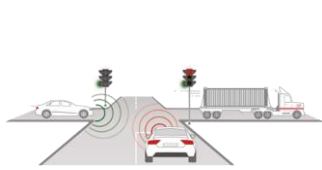
Enables vehicles to operate autonomously in GNSS-denied locations

Autonomous vehicles in mining operations can boost productivity 15-20%, according to research trials

Cohda's Product Portfolio

Cohda has developed a hardware agnostic software solution that is enabling hardware products to communicate in the fast developing autonomous vehicle market

Software: V2X-Stack

- Mature, hardware-agnostic V2X applications and stack
- Most deployed stack in this rapidly evolving sector with 60% market share
- Supports wireless 802.11p and 5G mobile networks
- Synthesizes data from nearby vehicles and roadside infrastructure to create broader zones of awareness
- Cohda software has been deployed over DSRC & LTE trials

Software: CAV Applications

- Solves critical CAV issues including localization, sensor fidelity and system cost
- Improves driving environment monitoring through V2X radar
- Optimizes traffic efficiency through cooperative cruise control
- Expands driving tasks through accurate positioning
- Better data collection

Chip Set Solution

- Cohda is experienced in the development of automotive grade SDR firmware
- Porting of software to multiple chip set vendors

On Board Unit ("OBU")

- Mature products, ready to be used in large scale field trials and aftermarket deployments
- Small, low cost module
- Powerful processor running V2X software stacks and applications
- V2X security with hardware acceleration and tamper-proof key storage
- Based upon the automotive-grade RoadLink™ chipset developed by NXP and Cohda
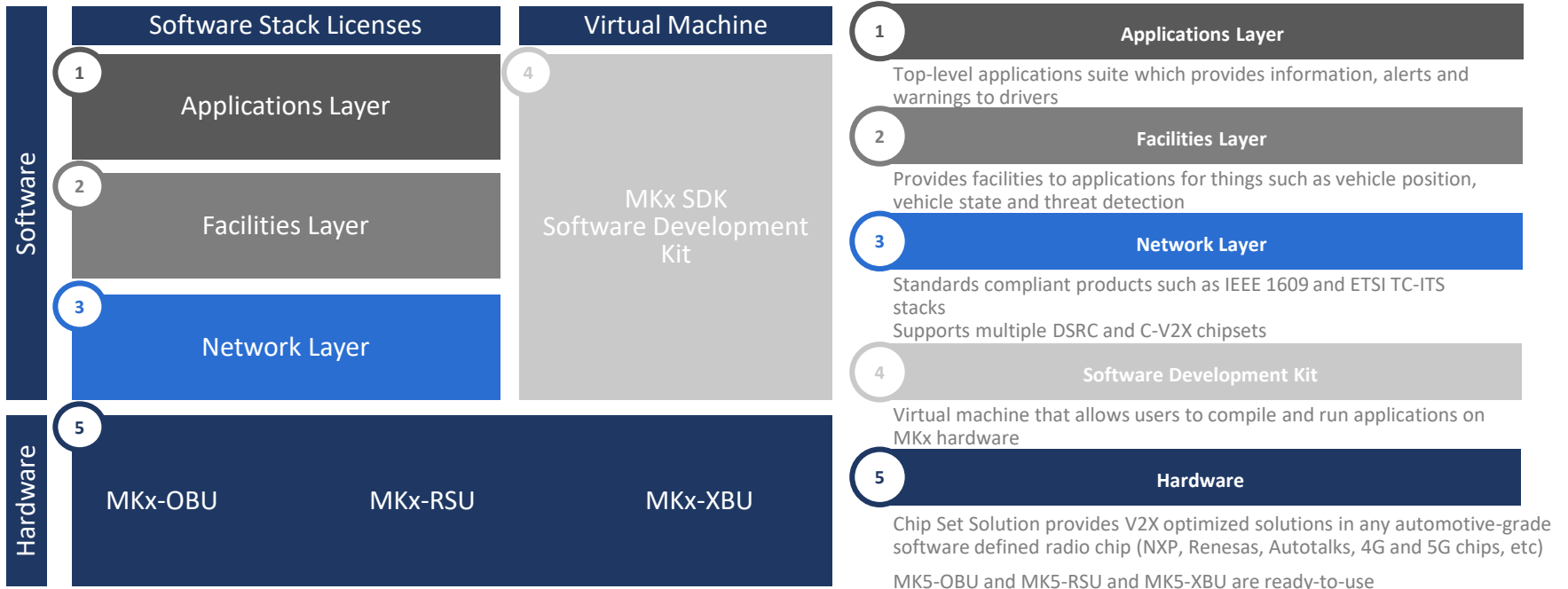- Unmatched radio performance in harsh outdoor environments

Road Side Unit ("RSU")

- Similar functionality as the OBU
- NEMA4 weather-proof enclosure with integrated antennas and a mounting kit
- Dual antennas to maximize range and coverage
- Covers all the approaches to an intersection with just a single, self-contained unit
- Available in both mains and power over Ethernet power options

Cohda's Technology Stack

Choosing to develop within the Cohda eco-system means that you are working with a solution backed by more than one million vehicle-days of testing, and applications that are the industry standard for V2X product development.

Software

Software Stack Licenses

1 Applications Layer

2 Facilities Layer

3 Network Layer

Virtual Machine

4 MKx SDK Software Development Kit

Hardware

5 MKx-OBU   MKx-RSU   MKx-XBU

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1 **Applications Layer**

Top-level applications suite which provides information, alerts and warnings to drivers

2 **Facilities Layer**

Provides facilities to applications for things such as vehicle position, vehicle state and threat detection

3 **Network Layer**

Standards compliant products such as IEEE 1609 and ETSI TC-ITS stacks
Supports multiple DSRC and C-V2X chipsets

4 **Software Development Kit**

Virtual machine that allows users to compile and run applications on MKx hardware

5 **Hardware**

Chip Set Solution provides V2X optimized solutions in any automotive-grade software defined radio chip (NXP, Renesas, Autotalks, 4G and 5G chips, etc)

MK5-OBU and MK5-RSU and MK5-XBU are ready-to-use

Cohda's Applications

Cohda's V2X applications provide vehicles with '360-degree awareness', detecting hidden threats by extending the horizon of awareness beyond what the driver can see. By gathering and synthesising data from sensors Cohda's solutions are proven to create a much broader zone of awareness.

V2X Applications	NA/EU	Maturity
• Emergency Electronic Brake Light (EEBL)	NA+EU	Production
• Stationary Vehicle Ahead (SVA)	NA+EU	Production
• Hazard Location Warning (HLW, CAMP definition) / Adverse weather Warning (C2C definition)	NA+EU	Production
• Intersection Collision Warning (ICW)	NA+EU	Production
o Intersection movement Assist (IMA)	NA+EU	Production
o Rear Cross Traffic Assist (RCTA)	NA+EU	Development
• Forward Collision Warning (FCW)	NA+EU	Field trial + OEM demo
• Left/Right Turn Assist (LTA)	NA+EU	OEM demo
• Lane Change Warning (LCW)	NA+EU	OEM demo
o Blind spot Warning (BSW)	NA+EU	OEM demo
o Motorcycle approaching Warning (MAW)	NA+EU	OEM demo
• Do Not Pass Warning (DNPW)	NA+EU	OEM demo
• Speed Compliance (SC, SPD-COMP, SPD-COMP / Work Zone)	NA	Field trial
• Curve Speed Warning (CSW)	NA	Field trial
• Oversized compliance (OVC)	NA	Field trial
• Evacuation/Emergency notification	NA	Field trial
• Spot Specific Weather Warning (ICE)	NA	Field trial
• Transit/Freight Signal Priority (TSP) (FSP)	EU	Field Trial
• Road Work Warning (RWW)	EU	Production
• Green Light Optimization Speed Advisory (GLOSA)	NA+EU	Production
• Signal Violation Warning (SVW)	NA+EU	Production
• In Vehicle Signage (IVS)	EU	Production
• Traffic Jam Ahead (TJA)	EU	Production
• Emergency Vehicle Warning (EVW)	EU	Production

OEM status: C-Samples Production / B-Samples Field trial / A-Samples OEM Demo

Standards & Technologies

Cohda development team consistently designs to meet industry standards to ensure technology advancements meet and exceed market needs.

US Standards	EU Standards	APAC Standards

• IEEE 802.11p*
 • IEEE 1609 WAVE*
 • 4G/LTE
 • 5G PC5 C-V2X
 	
 • SAE
   • DSRC Technical Committee
   • DSRC Vehicle Safety Subcommittee
 • Coexistence
   • IEEE 802.11 DSRC Coexistence Tiger Team
   • ITS America DSRC Coexistence Consortium
 	
 • USDOT PlugFests
	• ETSI C-ITS G5*
	 • 4G/LTE
	 • 5G PC5 C-V2X
	
	 • C2C-CC Member
	   • Active in WG-COM
	 • ETSI Member
	   • Active in WG4
	
	 • ETSI PlugTests
		• IEEE 1609 WAVE
		 • ETSI C-ITS G5
		 • 4G/LTE
		 • 5G PC5 C-V2X
		 • Country specific adaptation (compatible with the Korea trial requirements, 3000 vehicle deployed with Cohda stack)

* PICS list available on demand

Software Licensing Models

Licensing options available dependent on phase and project requirements.

Evaluation License	Development License	Production License
• For evaluation purposes only	• For developing a product incorporating the Cohda software	• For mass production incorporating Cohda software
• Restricts to run the software on Cohda MKx products	• One-off, up-front license fee	• Royalty based license
• Allows an evaluation of software without development commitment	• Prevent from going into production	
	• Restricted to 100 instantiations	
	• Allows the development of products without production commitments	

Deployment Examples

| V2X | CAV | SMART CITIES | MINING |

- 2017 General Motors Cadillac CTS
- 2017 O-Bahn Bus
- 2018 NVIDIA DRIVE™
- 2019 VW Golf
- 2019 VW Passat
- 2019 3rd OEM (still under NDA)
- Ducati Digital Shield Pilot
- Jaguar Land Rover Autonomous Trial
- Telstra V2X over LTE Trial

- C-Roads (Europe)
- Transport for NSW CITI trial
- Freight Signal Priority PoC in Sydney
- CITE Project (UK)
- C-ITS Corridor (NL/D/A)
- French SCOOP@F
- Safety pilot/ AACVTE
- Connected Vehicle Pilots: Wyoming, NY City
- Smart City- Columbus, Denver, Austin
- European Truck Platooning Challenge

- Trial: Peloton Platooning
- Trial: TfNSW Freight Signal Priority
- A2M2 Connected Vehicle Corridor (UK)
- AIMES Victoria (AU)
- ATP Automotive Testing Papenburg GmbH
- Qld, Cooperative and Automated Vehicle Initiative (CAVI)
- Rio Tinto Kennecott ,Utah

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