



Wireless Solutions for Future Mobility

Dr. Chris Borroni-Bird,
VP, Strategic Development, Qualcomm Technologies, Inc. (QTI)



to retire comfortably?

If you have a \$500,000 portfolio, download the guide by Forbes columnist and money manager Ken Fisher's firm. It's called *The Definitive Guide to Retirement Income*. Even if you have some [redacted] use in place right now, it *still* makes sense to request your guide! [Click Here To Download Your Guide!](#)

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Sam Abuelsamid Contributor

A lifetime in the car business, first engineering, now communicating

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AUTOS 5/23/2016 @ 8:44AM | 14,028 views

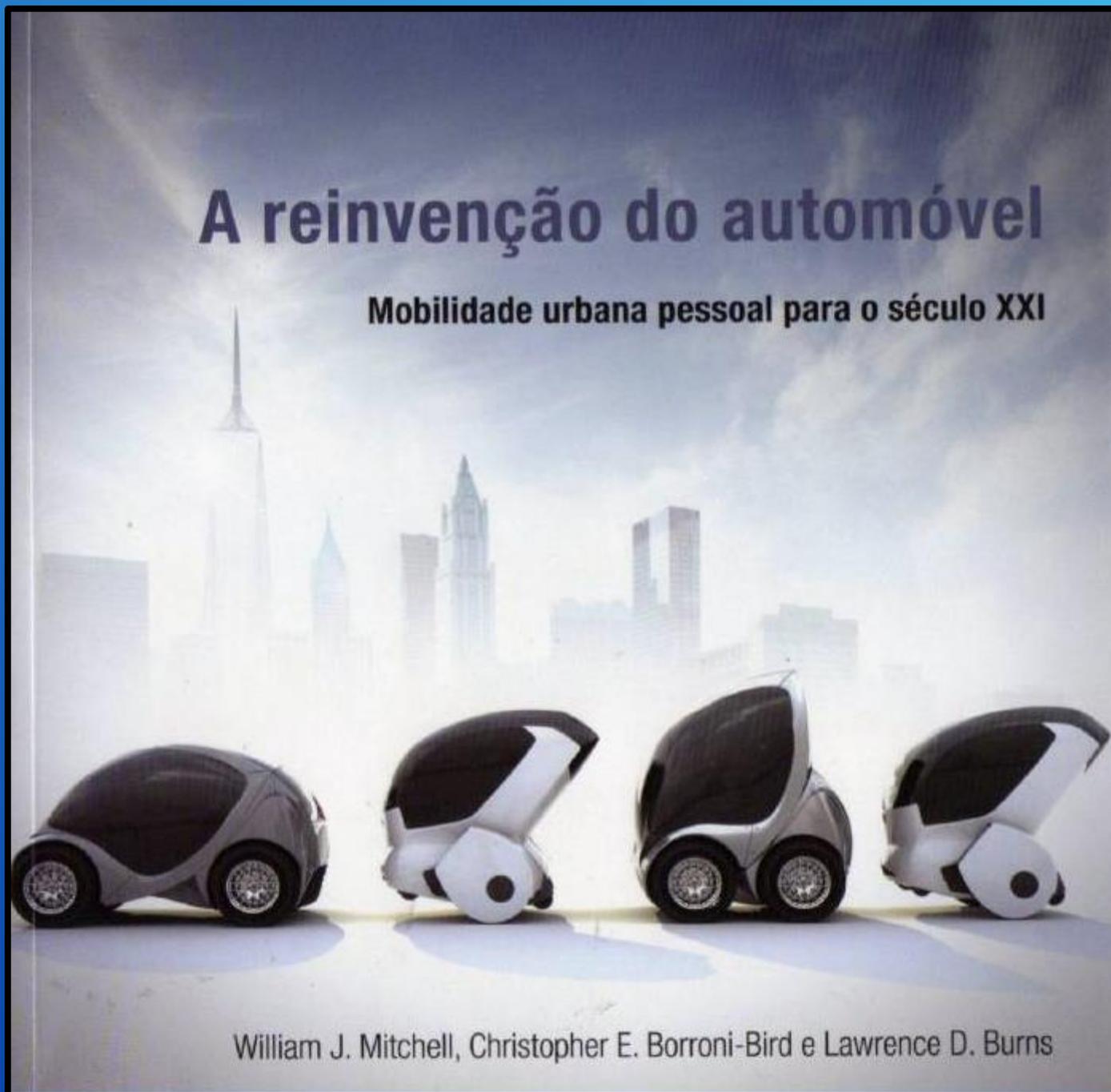
Meet The Father Of The Auto 'Skateboard' Chassis Used By Tesla: Chris Borroni-Bird



The 2002 GM AUTOnomy skateboard chassis concept (image credit: General Motors)

[Elon Musk](#) absolutely deserves a great deal of credit for popularizing the idea that a battery powered car could be a viable mainstream transportation product. The cult of personality around Musk is in large part the catalyst for Tesla securing 400,000 pre-orders for the Model III well before it goes on sale. Yet as in most industries there are those that work in far more anonymity than Musk while exerting much greater influence on the long-term future of that business. One of those influencers is Dr. Christopher Borroni-Bird, an engineer and researcher who has been helping to shape the future of mobility over the past two decades.

Borroni-Bird is currently vice-president of strategic development for Qualcomm Technologies, a company best known for the



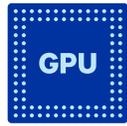
Our technology is enabling the connected car experience today



Multimedia



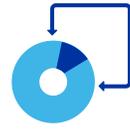
Power Management



GPU



RF



Software/
HLOS



Position/
Location



Powerline



Ethernet



Security



Multi-OS support



DSP



Wi-Fi /
DSRC



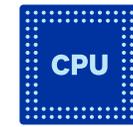
Bluetooth



Wireless EV
Charging



3G/4G LTE



CPU



Computer
Vision



Use cases for car connectivity continue to grow

Past

- Emergency crash notification
- Remote lock/unlock, start
- Stolen vehicle recovery
- Diagnostics



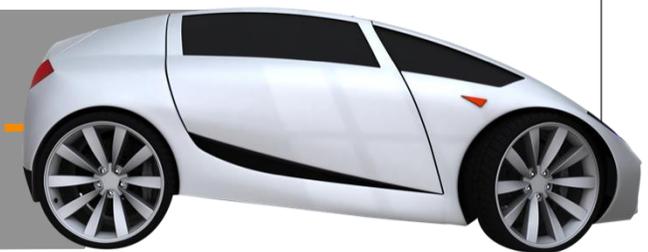
Present

- BYOD, Wi-Fi hotspot
- Connected navigation
- Infotainment
- Screen mirroring / projection
- System updates
- App-enabled vehicle management



Future

- Phone-based access and personalization
- Car sharing credentials management
- Post-sale upgrades
- Big data analytics
- ADAS / V2X
- Semi-autonomous operation
- Autonomous driving



Our vision for the always-connected vehicle of the future

A safer, more efficient, more enjoyable driving experience



Safer—towards zero road accidents

Greener—reduce air pollution & emissions

More predictable and productive travel

Delivering significant economic and societal impact

Total potential economic impact of over \$1 Trillion USD per year¹

Fewer driving
fatalities/injuries

>1.2M

people die each year
on the roads worldwide²

More predictable,
productive travel

3.1B

gallons of fuels wasted due
traffic congestion in the US³

Less greenhouse
gas emissions

14%

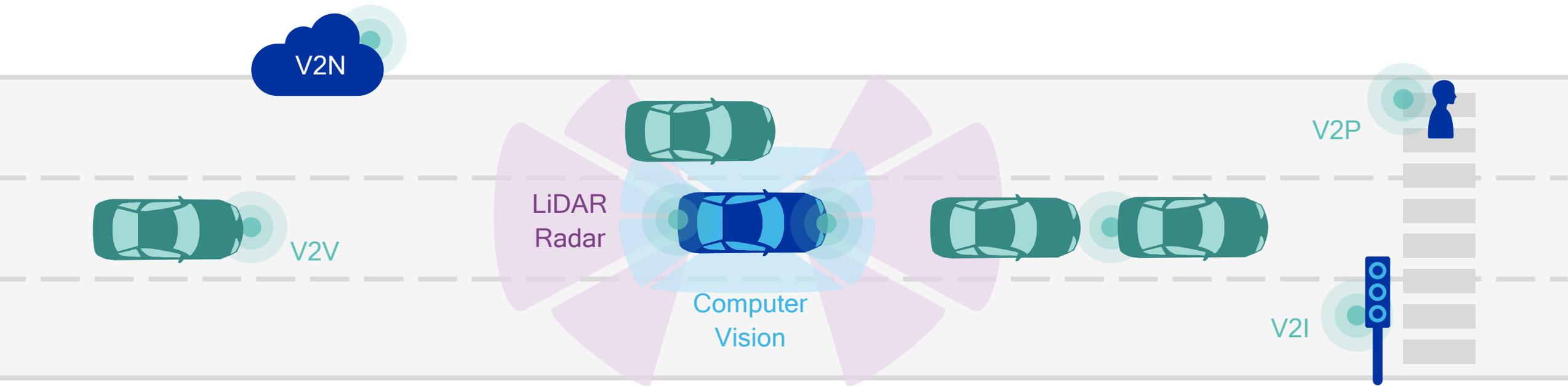
of all global warming
emissions from transportation⁴

¹ Rocky Mountain Institute 2016; ² Global Status Report on Road Safety, World Health Organization 2015; ³ Texas Transportation Institute Urban Mobility Report, 2015;

⁴ U.S., Environmental Protection Agency (EPA) 2014

V2X is a key technology enabler to enhanced ADAS

Bringing significant value to Advanced Driver Assistance Systems (ADAS)



Improved active safety

Provides 360° non-line-of-sight awareness, e.g. intersections/on-ramps, environmental conditions

Better traffic efficiency

Allows vehicles to safely drive closer to each other and enables optimization of overall traffic flow

Increased situational awareness

Provides ability to gather data from further ahead to deliver a more predictable driving experience

Vehicle to Pedestrian Communications

Honda and Qualcomm
Technologies, Inc.
collaborate on research for
V2P safety applications

Honda



Vehicle-To- Pedestrian

Cooperative Safety Application

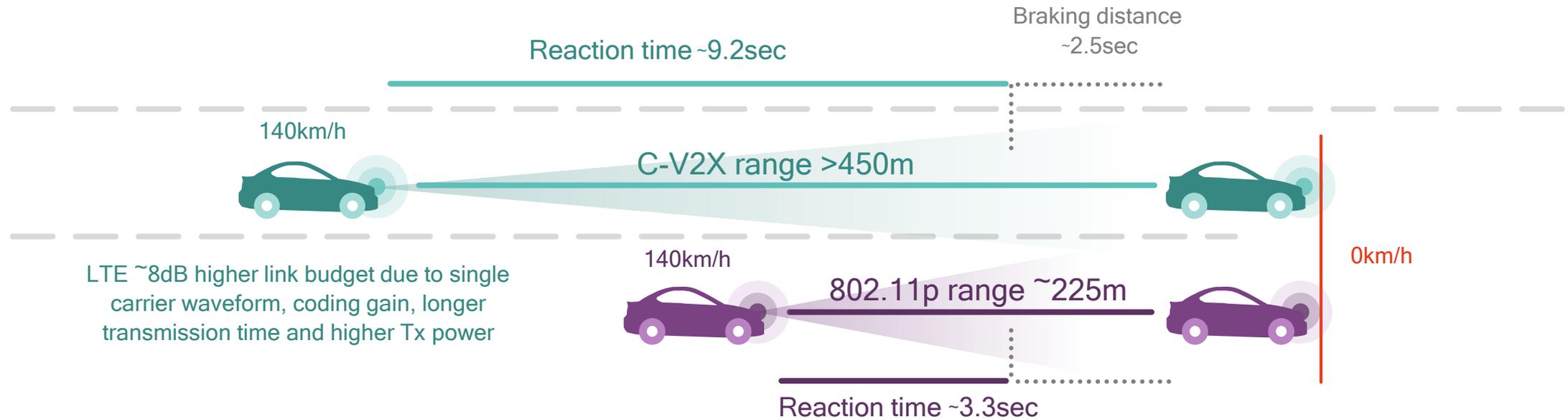




Pedestrian Accident Avoidance Technology

C-V2X increases reaction time over 802.11p/DSRC

For improved safety use cases - especially at high-speeds, e.g. highway



Safer driving experience

Increased driver reaction time

Support for high speeds

Relative speeds up to 500km/h

Increased situational awareness

Gather data from further ahead

Autonomous vehicle technology enablers

Support for server computing & route planning (V2C)



LTE

Navigation & Path Prediction

- Real-time obstacles on road features & obstacles

Direct Connect using LTE-Direct

- Reduced bandwidth & improved latency

Supporting Technologies

- Security
- Safety

Wi-Fi Based Point-to-Point

- V2V
- V2I
- V2P



DSRC

Maps and Localization

Front Camera, Surround Vision

LTE-Direct

FUSION

Lidar



Radar



Toward Autonomous Car

Ultrasonic Sensors

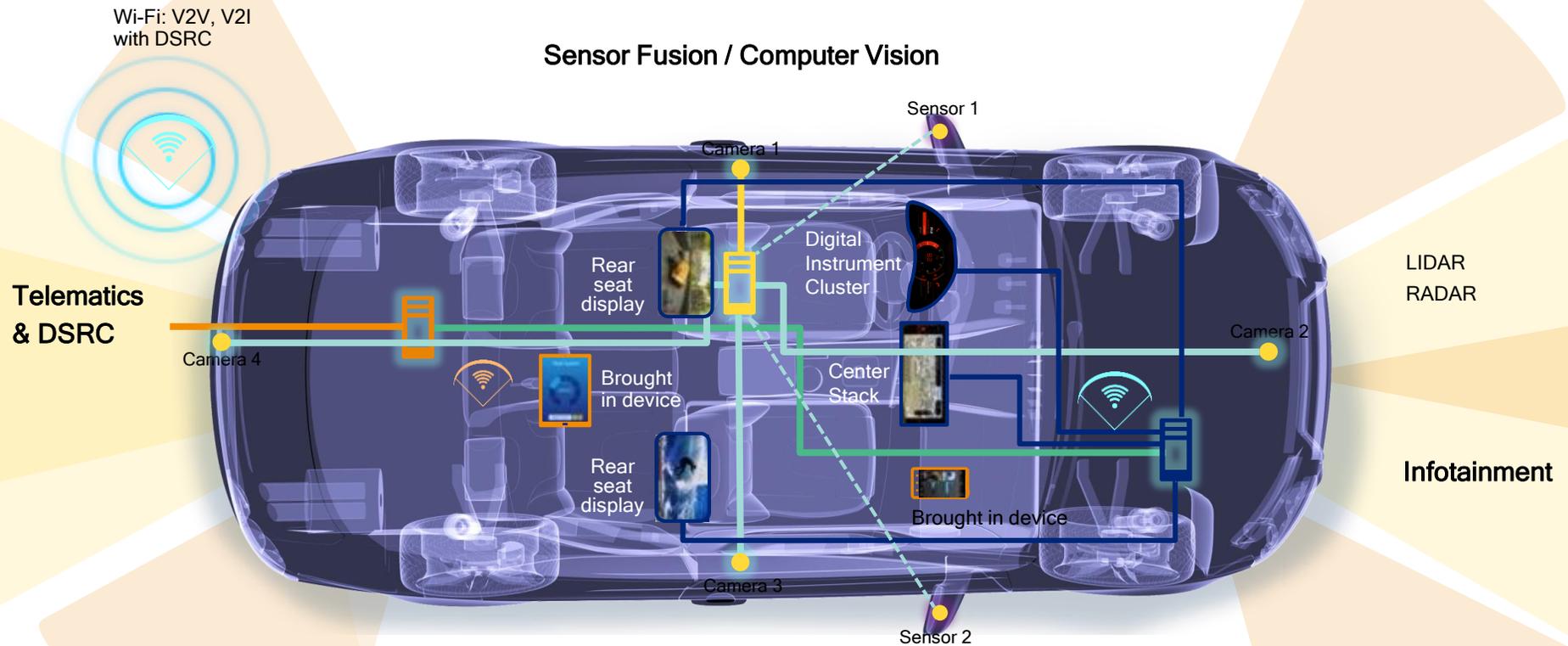
Computer Vision & Deep Learning Networks

- AEB
- LKA
- ACC
- TSR

Power Optimized Brain for the Vehicle

- Fusion of information from multiple sensors/sources
- Path Prediction, Route Planning, Control Feedback

Automotive Platform

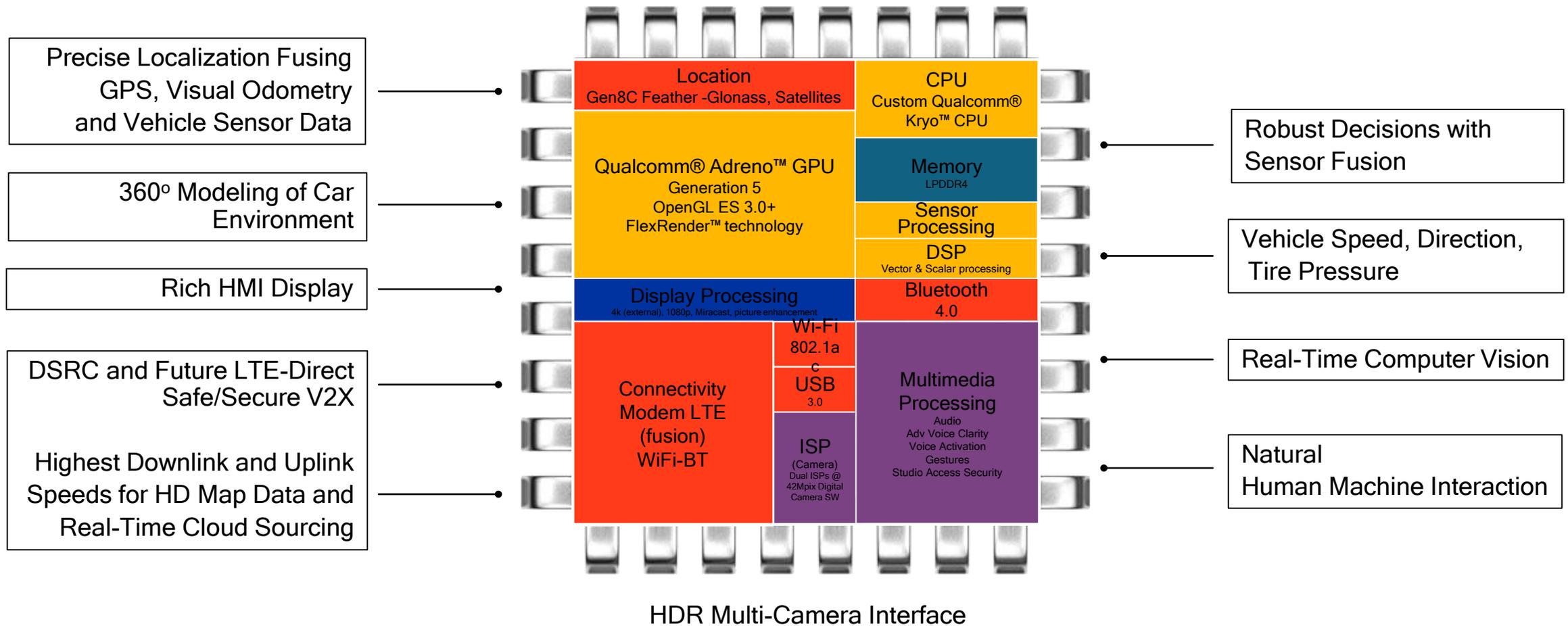


- Entertainment, Real-time Navigation & Safety Domains
- Sensor on Wheels

- Hub for Big Data
- Massive Processing Engine
- Always Connected - P2P and Cloud

- Telematics**
- Infotainment**
- Sensor & Vision Processing**

Integrated SoC improves costs effectiveness



* For automotive, modem will be non-integrated and available as a module.
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The future of automotive: smart, connected, secure, and safer

Present: 3G

Future: 4G/5G

Vehicle-to-cloud communication

Vehicle-to-vehicle communication

Wireless EV charging

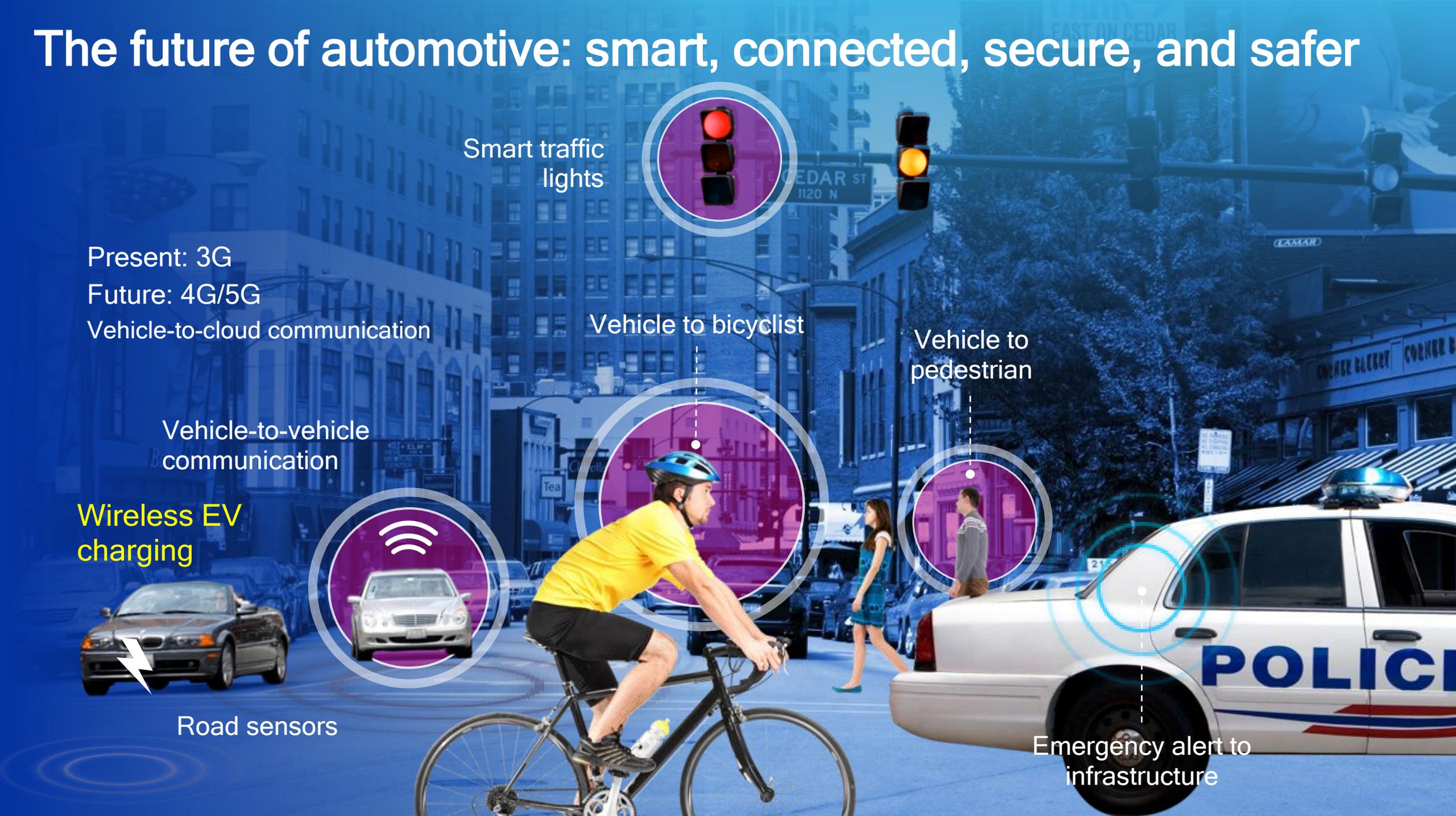
Road sensors

Smart traffic lights

Vehicle to bicyclist

Vehicle to pedestrian

Emergency alert to infrastructure



Qualcomm Halo™ Technology

Wireless electric vehicle charging (WEVC) power options:
3.7kW, 7.4kW, 11kW & 22kW

High power

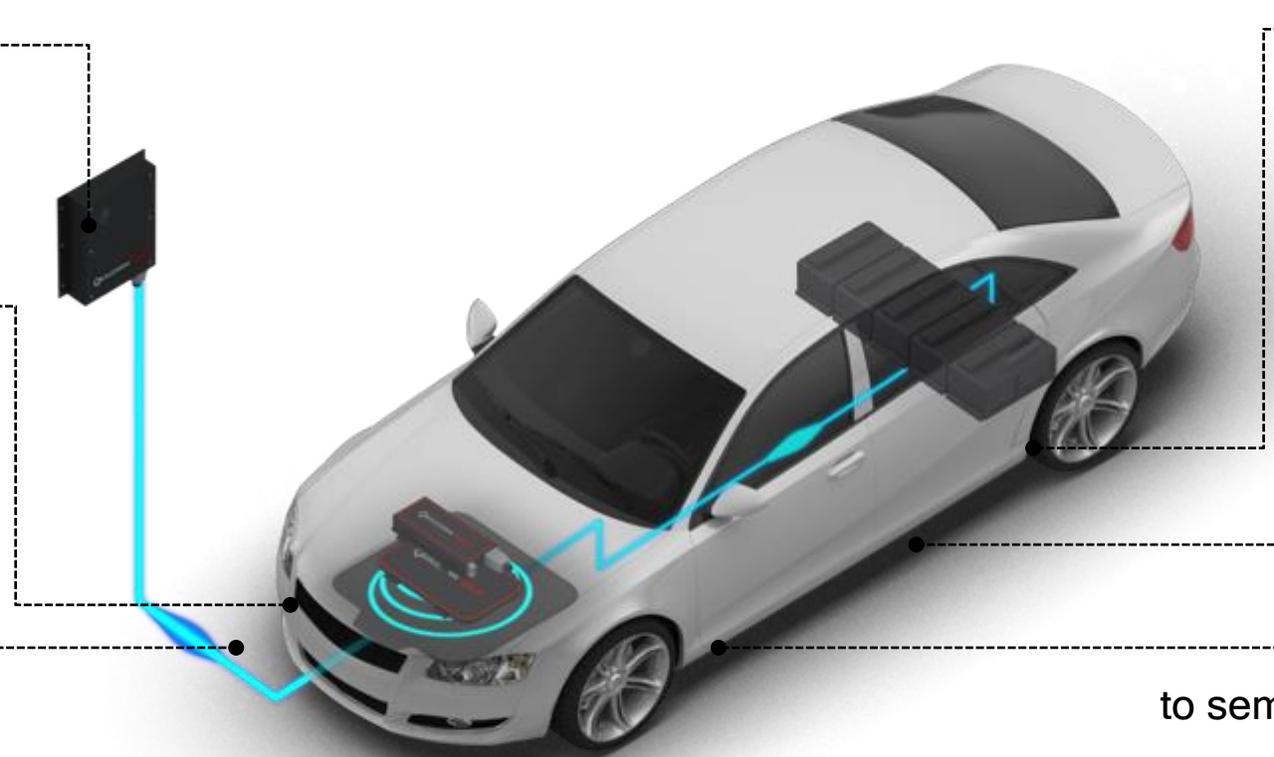
wireless EV charging

Support for

low- and high-ride vehicles

Simple

and easy operation



Standardized

85kHz operating frequency

Safe

with foreign object
detection, EMC, RF
and other safety
features

Roadmap

to semi- and full-dynamic charging



Energy and Environment



⚡ Static WEVC



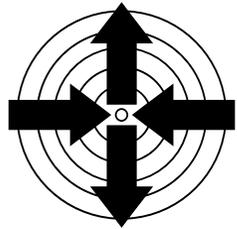
⚡ Semi-Dynamic WEVC



⚡ Dynamic WEVC

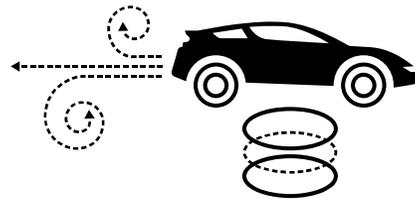
Smart Transportation

Greater safety, convenience and efficiencies for the next generation of connected vehicles



Safety

Enhance safety with dedicated short-range communications (DSRC/IST-G5) for vehicle-to-vehicle and vehicle-to-infrastructure connectivity that relays road hazards, traffic and other information



EV Charging

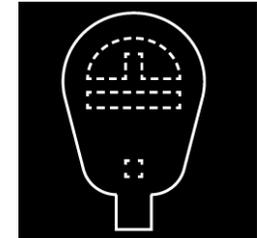
Make electric car charging easy and accessible with Qualcomm Halo™ Electric Vehicle Charging



Traffic

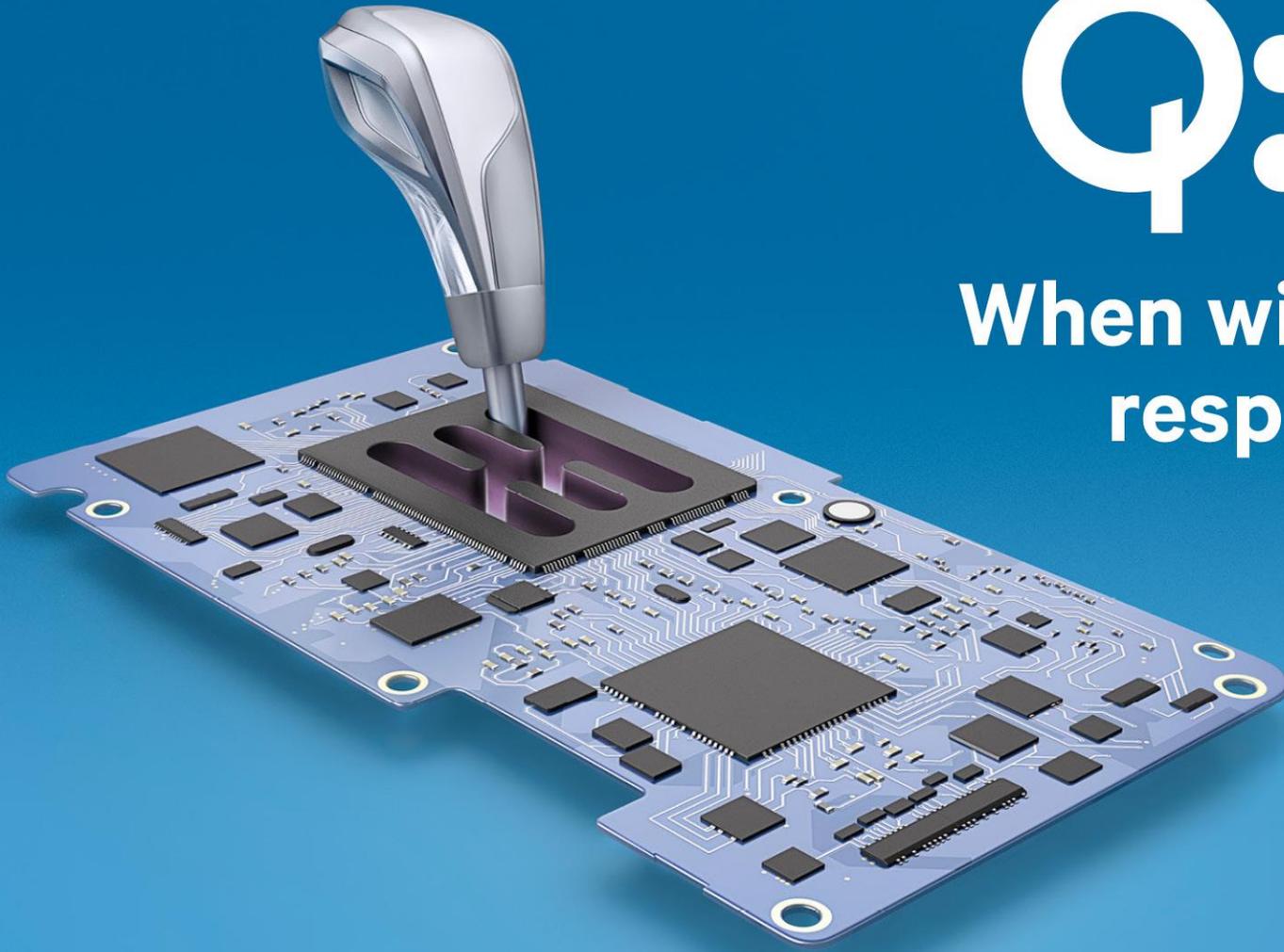
Reduce costs, congestion and CO₂ emissions with multimodal transit & traffic management.

Enable computing power at the edge of the network via smart traffic cameras or digital signage.



Parking

Monitor parking usage and space patterns to dynamically assist with traffic congestion, adjust pricing and increase revenues.



Q:

**When will our cars
respond to more
than just the road?**

Why Wait™

QUALCOMM®

Thank you

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