You know us for our consumer products ...
But we’ve evolved ...
Panasonic is a leading global supplier of automotive systems & technologies
Why does all of this matter?

U.S. Motor Vehicle Traffic Deaths

- 2014
- 2015
- 2016
- 2017

SOURCES: NHSTA and National Safety Council
Today’s cars have a lot to say ...

- Lane departure system
- Temperature/light sensor
- Front object CCD camera
- **Windshield wiper set**
- Pedestrian warning
- **Airbag sensors**
- Infotainment System
- Front object laser radar
- Nighttime pedestrian warning IR sensor
- **Road friction sensor**
- Tire pressure sensor
- GPS/Telematics
- Side curtain sensor
- Rear camera
- Blind spot detection
- Cross traffic alert
- Rear object laser radar
- **Wheel speed sensor**
- Central computer
- **Collision sensor**
- Side airbag SRS
- Steering angle sensor
- Adaptive cruise control
- **Traction control system**
- Wheel speed sensor
All of I-70 in Colorado

I-70 Mountain Corridor (90 miles)

Statewide Deployment

82 million messages per hour
23 Gb per hour

270 million messages per hour
76 Gb per hour

2.12 billion messages per hour
592 Gb per hour
V2X Technology Approach

Choose Applications → Write Use Cases → Develop Functionality
V2X Technology 4-Level

1. Identify Needs
2. Target Functionality to Meet the Needs
3. Develop Use Cases Implementing the Functionality
4. Develop Applications Implementing the Use Cases
Signage
Traffic Lights
Emergency Alert
Fast Data Platform
Existing Traffic Management Platform
DATA
Input sources
Cameras
Sensors
Weather
Etc...
Output sources
V2V DATA
RSU
Camera
Sensors
Weather
Input Sources
Existing Traffic Management Platform
V2I DATA
RSU
Signage
Traffic Lights
Emergency Alert
V2V Data
V2I Data
Connected Cars Deployment Outcomes

- Prevent 80% of non-impaired crashes
- Save 21,500* lives
- Save thousands of additional lives through faster emergency response

- Improve freeway travel times by 42%
- Improve arterial travel times by 27%
- Reduce poor weather incidents by 25%

- Improve fuel savings by 22%
- Reduce VMT by 20%
- Improve freeway travel times by 42%

*based on 2017 traffic fatalities statistics
Current deployment in Colorado

90 mile stretch of I-70
From Golden, CO to Vail, CO
CDOT & Panasonic

Panasonic = Connected Vehicle Foundation

How do we build a meaningful network at a scale that begins solving problems?
Stage 0

Funded
Managed Lanes, Panasonic

I-70 W
I-70 Central
I-25 N (sect 7-8)
I-25 S Gap
C-470
Blank Slate

New digital infrastructure

Transportation systems becoming information systems

Roadways will be influenced by digital messages

Ability to influence and improve roadway conditions
Internet of Roadways (IoR)
IoR Factors

Safety

Mobility

Freight

Sum of LOSS, V/C, AADTT, & Crashes

- 4-6
- 6.01 - 9
- 9.01 - 14.5
IoR Factors – cont’d

Fiber
Air Quality
Regional Coverage
Interstate Corridors

Planned Fiber ...............  
Existing Fiber _________________
## Safety Benefit Analysis

Quantifying the safety benefits of connected vehicles

<table>
<thead>
<tr>
<th>Connected Vehicle Application</th>
<th>CMF Equivalent</th>
<th>% Reduction (PDO, Injury, Fatality)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spot Weather Warning</td>
<td>Variable Message Signs</td>
<td>25%</td>
</tr>
<tr>
<td>Roadway Departure Warning</td>
<td>Rumble Strips</td>
<td>11% - 16%</td>
</tr>
<tr>
<td>Queue Warning</td>
<td>Queue Ahead Warning</td>
<td>16%</td>
</tr>
<tr>
<td>Dynamic Speed Harmonization</td>
<td>Variable Speed Limits (VSL)</td>
<td>19%</td>
</tr>
</tbody>
</table>

First-ever methodology created by CDOT Traffic Safety (David Swenka)
Safety Benefit Analysis – cont’d

<table>
<thead>
<tr>
<th>Category</th>
<th>5% Saturation</th>
<th>10% Saturation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spot Weather</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Queue Warning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road Departure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic Speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
EXAMPLE: I-25 in Region 1

Total Benefit = $24 million (10%)

Total Cost = $3,300,000 ($50k/mile)

C/B Ratio = 7.4 to 1