

The Typo That Almost Cost \$5 Million



APTIV CONNECT HELPED A MANUFACTURER FIND AND FIX A SOFTWARE ERROR IN THE NICK OF TIME, PREVENTING A RECALL.

Today's vehicles rely more heavily on software than ever before. A modern high-end luxury vehicle typically has more than 100 million lines of code controlling all its systems. To put that in perspective, a US military drone runs only about 3.5 million lines of code, the Mars Curiosity Rover 5 million, the F-35 fighter jet about 24 million, and even all of Facebook (including the back-end servers) needs just 62 million lines of code.*

That software has helped make vehicles safer and greener, as well as enabling innovative new features. However, relying so heavily on software also introduces the possibility that a simple typo somewhere in those millions of lines of code could cause an expensive problem in the vehicle.

Those potential problems aren't just theoretical. According to one study, the percentage of total vehicle recalls that were due to software problems tripled between 2011 and 2015, and programming-related recalls have continued to rise since then.

RESULTS AT A GLANCE



1,500 new vehicles updated in time for scheduled launch



More than \$5 million in costs avoided

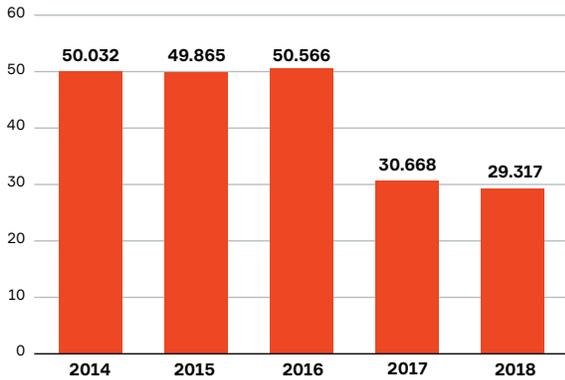


Mandatory recall prevented

* Data from Information is Beautiful. <https://informationisbeautiful.net/visualizations/million-lines-of-code/>

RECALLED VEHICLES — US MARKET

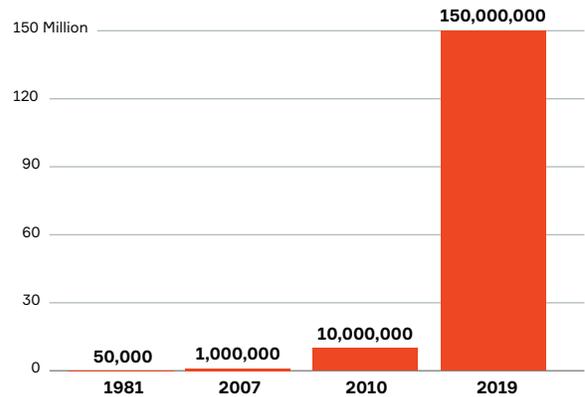
Recalled Vehicles — US Market



Source: National Highway Transportation Safety Administration (NHTSA)

TYPICAL SOFTWARE LINES OF CODE

Per vehicle



Source: IEEE, McKinsey & Company, The New York Times

And those recalls can be costly. Manufacturers spend more than \$10 billion annually addressing warranty and recall issues. Given that reality, OEMs need to find and fix software bugs before shipping a new vehicle.

Challenge

A light-duty vehicle manufacturer was launching a new model in 10 months. That gave the company's engineers a very tight deadline for resolving any unknown problems.

With the launch date set, the company planned a major marketing push. Millions of dollars were on the line as the countdown toward launch day began.

Solution

To assist with its pre-production validation efforts, the manufacturer deployed Aptiv Connect, an end-to-end vehicle quality application. To collect the vehicle software data, the OEM installed Aptiv Connect's Dynamic Edge hardware in 27 different test vehicles.

With its previous pre-production validation processes, the OEM could access only legislative data. Essentially, the engineers didn't know about problems with the test vehicles unless they were significant enough to turn on the check-engine light. However, the Aptiv solution allowed the company to access rich data streams from thousands of different signals. Aptiv Connect helped analyze the data, create visualizations, generate reports, and set up

“The manufacturer saved at least \$5 million that would have been necessary to fix the vehicles after shipments.”

alerts to notify the team in real time of any problems with the vehicles.

Results

Just six days before the scheduled launch day, the engineers detected a problem that would have gone undiscovered if they hadn't deployed Aptiv's tools. Using Aptiv Connect to assist with root-cause analysis, they discovered that a threshold had been typed incorrectly into the vehicles' software.

At the time, 1,500 completed vehicles were sitting in the yard ready to ship to dealers the following Tuesday. The engineering team corrected the calibration problem and spent Tuesday testing the fix. On Friday, they began re-flashing the vehicles, and by Sunday, all 1,500 were ready to go with time to spare.

The manufacturer saved at least \$5 million that would have been necessary to fix the vehicles after shipment. It also avoided the brand damage that would have resulted from a required recall, and it was able to maintain its launch schedule, making the most of its marketing investments.

ABOUT APTIV

Aptiv is a global technology leader, with more than 160,000 people across more than 125 manufacturing facilities and 15 major technical centers worldwide. With a presence in 44 countries, we address mobility's toughest challenges through our deep software and systems integration expertise, delivering market-relevant solutions for our customers.

Aptiv brings unparalleled capabilities in solving our customers' complex challenges. We are unique in that we can integrate whole systems through Smart Vehicle Architecture™ — operating as the brain and nervous system of the vehicle — enabling electrification, active safety, and connectivity.

Our mission is to make the world safer, greener and more connected than ever before. As these trends converge and the world of mobility changes, we will lead this change.

Mobility has the power to change the world, and we have the power to change mobility.

BY THE NUMBERS

Savings
\$5M



Test vehicles
27



Project timeline
10 months



Miles driven
180,989



Vehicles flashed before launch
1,500