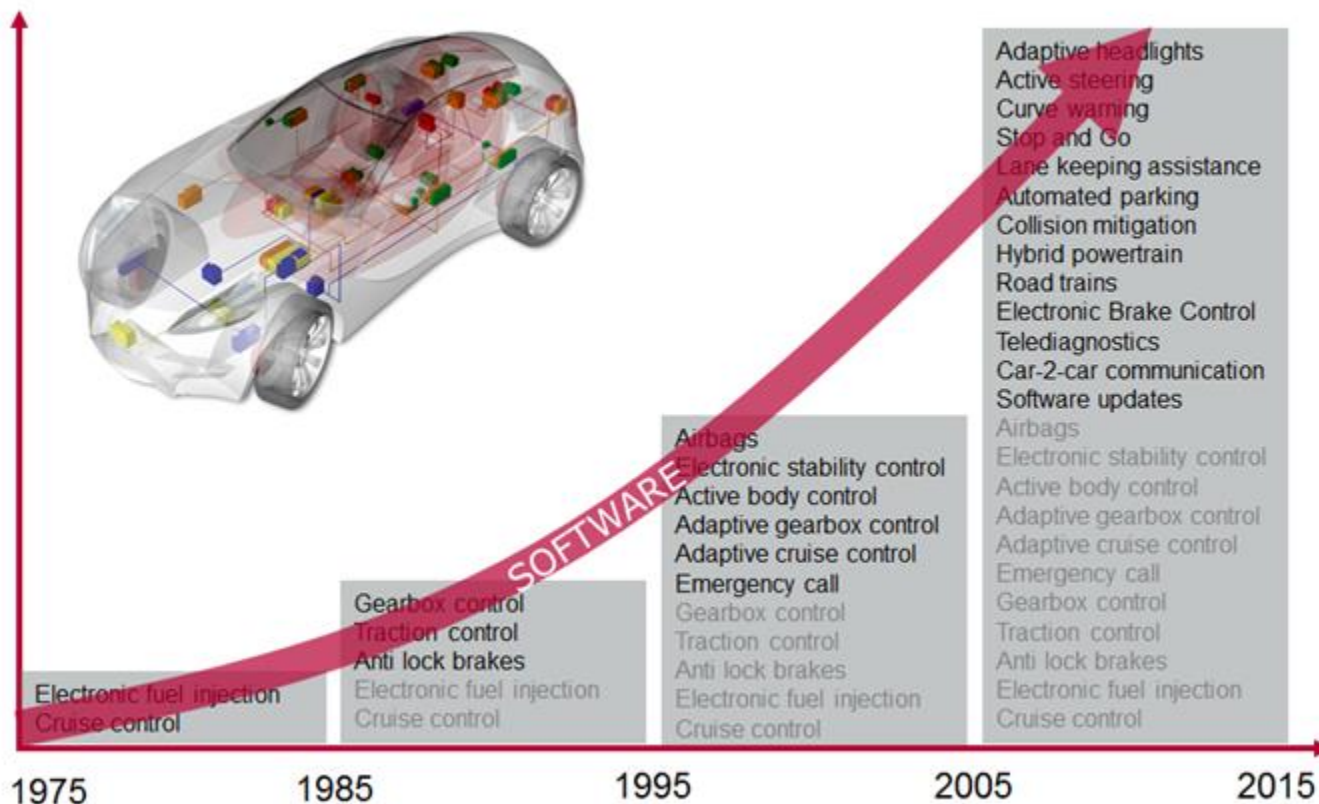




Cybersecurity Considerations in Today's Connected and Autonomous Vehicles

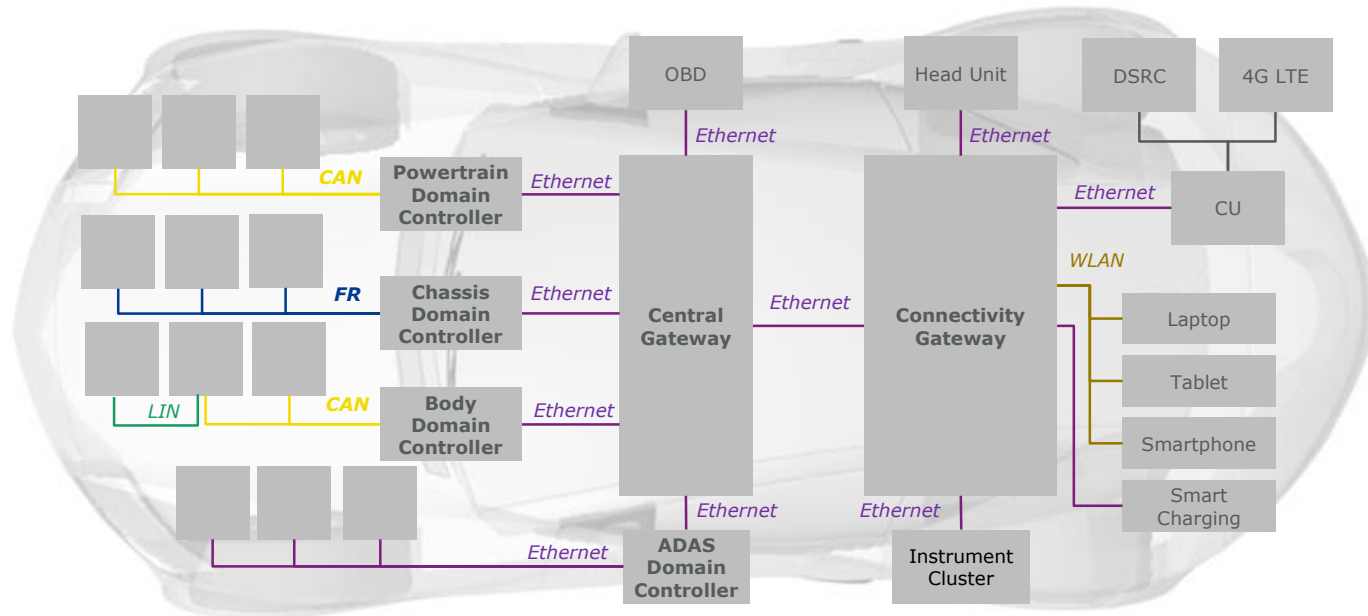
Stephen Waldron – Local Product Line Manager – Vector GB Limited

The Growth of Vehicle Electronics and Software



Typical E&E architecture in a state-of-the-art vehicle

- ▶ Central gateway architecture
- ▶ Connectivity gateway
- ▶ Domain controllers and “Domains”



SAE J3016: Definitions for Terms in Vehicle Automated Driving Systems

SAE J3016 identifies six levels of driving automation, from “no automation” to “full automation”:

Level 0 No Automation

- ▶ The full-time execution of the driving task by a human driver, even when enhanced by warning or intervention systems.
- ▶ *Examples:* ABS, front collision (distance) warning, blind spot monitoring

Level 1 Driver Assistance

- ▶ The execution by a driver assistance system of **either** steering **or** acceleration/deceleration (but only within a specific driving scenario).
- ▶ *Examples:* Cruise Control **or** Lane Keep Assist, Brake-Controlled Park Assist

Level 2 Partial Automation

- ▶ The execution by multiple driver assistance systems of **both** steering **and** acceleration/deceleration (but only within a specific driving scenario).
- ▶ *Examples:* Adaptive Cruise Control **and** Lane Keep Assist, Autonomous Park Assist

SAE J3016: Definitions for Terms in Vehicle Automated Driving Systems

SAE J3016 identifies six levels of driving automation, from “no automation” to “full automation”:

Level 3 Conditional Automation

- ▶ The execution by multiple driver assistance systems of **all** aspects of the driving task, *however* the human driver will respond to a request to intervene (but only within a specific driving scenario).
- ▶ *Examples:* Road Train, Tesla Model S “Autopilot” feature

Level 4 High Automation

- ▶ The execution by multiple driver assistance systems of **all** aspects of the driving task, *even if* the human driver does not respond to a request to intervene (but only within a specific driving scenario).
- ▶ *Examples:* Valet Parking, Highway Pilot

Level 5 Full Automation

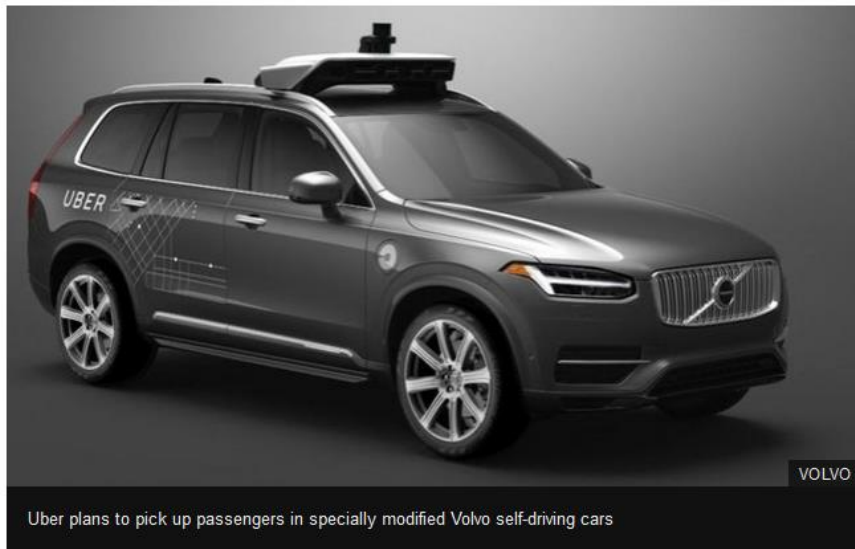
- ▶ The full-time execution by multiple driver assistance systems of **all** aspects of the driving tasks, under all roadway and environmental conditions.
- ▶ *Examples:* Robot Taxi, Google Car

Where is the autonomous car going?

Technology

Uber to deploy self-driving cars in Pittsburgh

🕒 1 hour ago | Technology



Uber plans to pick up passengers in specially modified Volvo self-driving cars

The ride-sharing firm Uber will, for the first time, allow users to hail self-driving cars within a fortnight, the company has confirmed.

Uber said the launch would take place in Pittsburgh, Pennsylvania. It added that it was **teaming up with Volvo**.

At first, the vehicles will be supervised by a driver, who can take control if necessary, and an observer, **Bloomberg** reported.

The firm first revealed plans to **replace human drivers two years ago**.

More than one million people drive vehicles linked to its app, but are not directly employed by the company.

A spokeswoman for the firm told the BBC: "Starting later this month, Uber will allow customers in downtown Pittsburgh to summon self-driving cars from their phones, crossing an important milestone that no automotive or technology company has yet achieved.

"In Pittsburgh, customers will request cars the normal way, via Uber's app, and will be paired with a driverless car at random. Trips will be free for the time being, rather than the standard local rate of \$1.30 [£0.98] per mile."

Source: <http://www.bbc.com/news/technology-37117831> 18/08/2016

Who Doesn't Learn from History Is Doomed to Repeat It

1980s: IT Systems were

- ▶ Complex
- ▶ Distributed
- ▶ Software intensive
- ▶ Perceived as secure

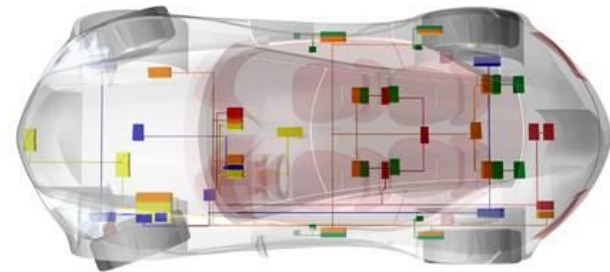
Then came the Morris worm



2016: Vehicle Systems are

- ▶ Complex
- ▶ Distributed
- ▶ Software intensive
- ▶ Perceived as secure

Then came ...



Why do we need Cybersecurity in a vehicle?

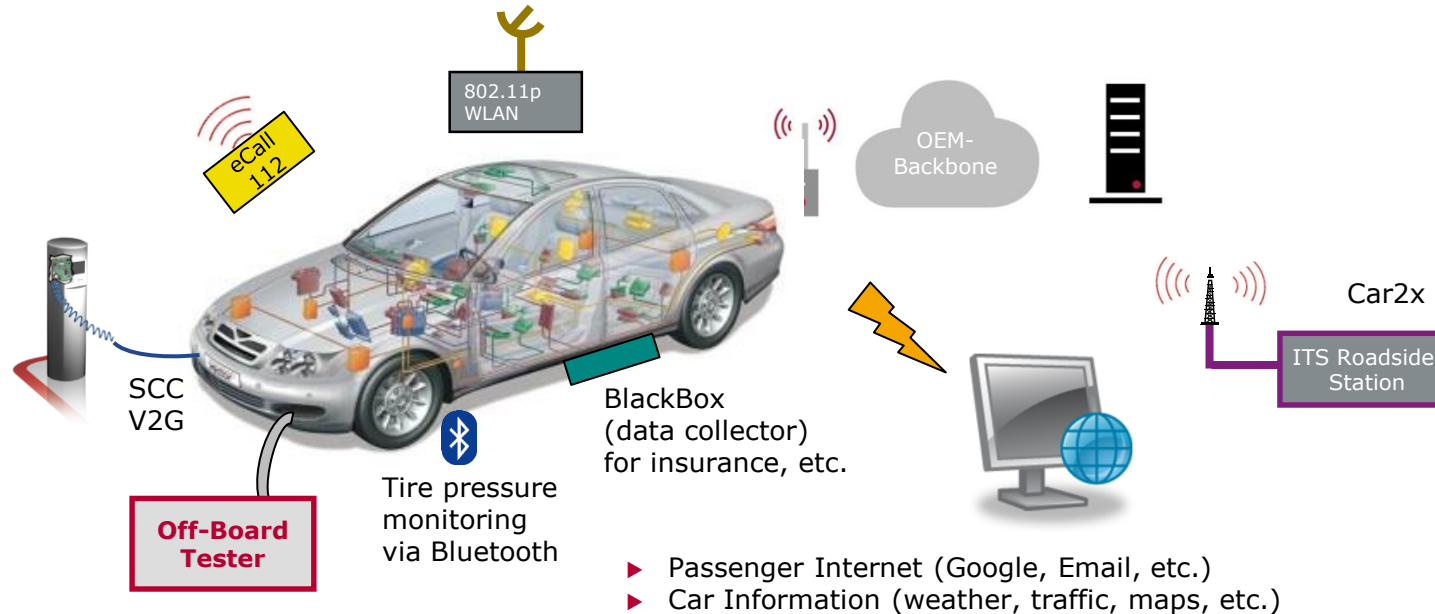


Hackers remotely kill a Jeep at 70mph

<http://www.wired.com/2015/07/hackers-remotely-kill-jeep-highway>

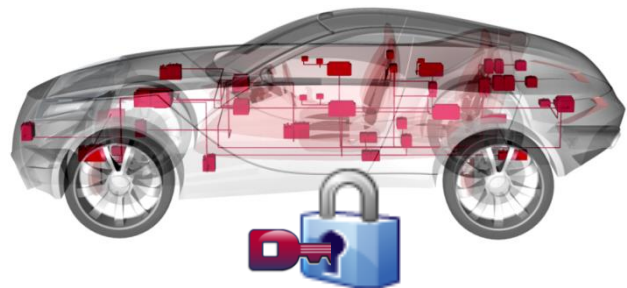
Hackers remotely kill a Jeep at 70mph – how can this happen?

1. The car is becoming increasingly connected => more “attack surfaces”



2. The car contains more ADAS systems that can be electronically controlled (via Ethernet)

What methods of Cybersecurity can we apply in the vehicle?



► **Authentication**

The sender adds a digital signature to the data, which confirms to the receiver, that the data is authentic and is actually from the sender. Additionally, the sender cannot deny that they sent it.

► **Integrity**

The data is complete, nothing has been changed, added or removed.
Authenticity and Integrity are often closely coupled.

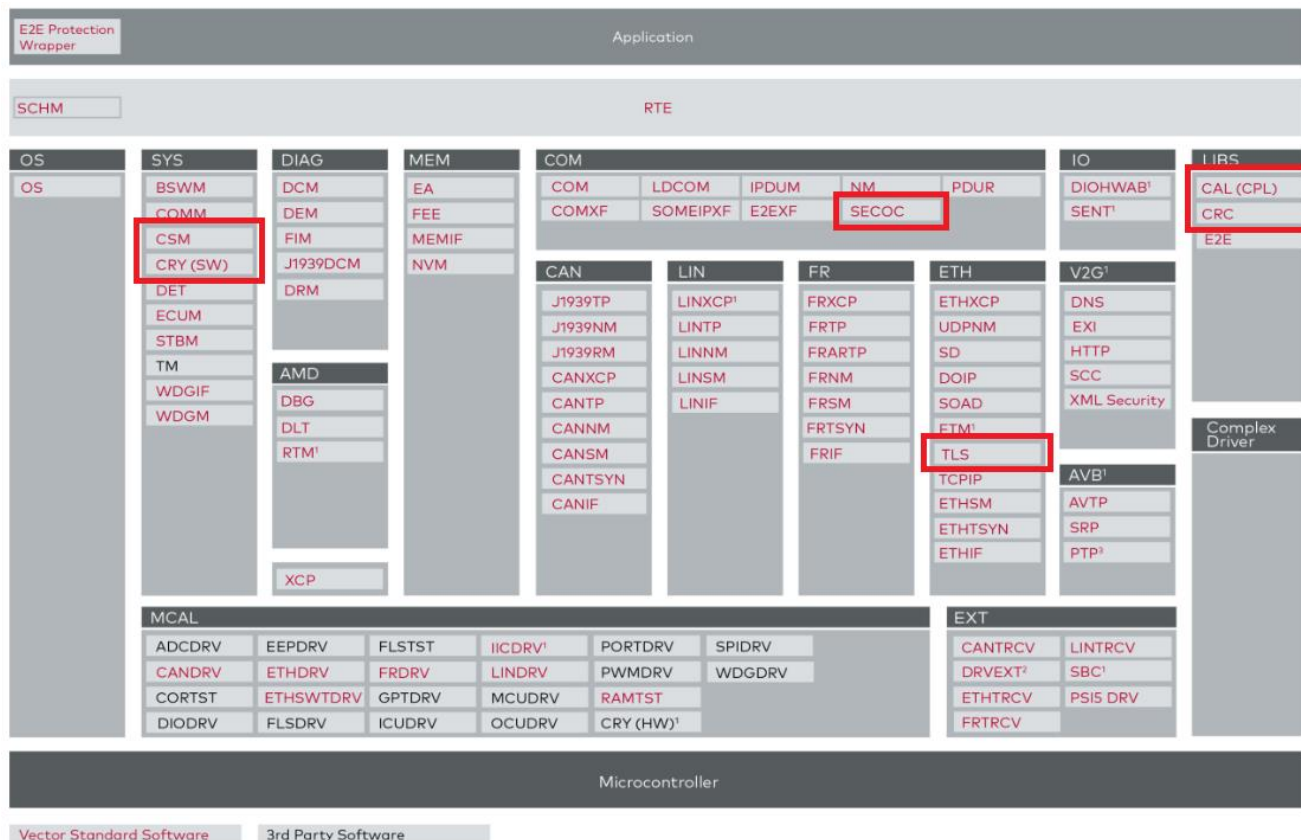
► **Confidentiality**

The sender encrypts the data and only the receiver is able to decrypt and read it. Sometimes, a key exchange is needed to start. Only the one who holds the key can decrypt the data.

► **Protection**

Prevent any intrusion of the vehicle data. No one can “snoop” bus communication data, manipulate vehicle data, read out internal data from the ECUs, or change data communications.

AUTOSAR standard software supports Security in Automotive ECUs



Thank you for your attention!

For more information
come and see us on Stand C2-23

Or visit: www.vector.com

Stephen Waldron
Vector GB Limited