OKOS VÁROS SZAKIRÁNY

INTELLIGENS KÖZLEKEDÉSI RENDSZEREK

LIMP, Andras
Inventure Automotive

FIELDS OF COMPETENCE

FLEET MANAGEMENT SYSTEMS	CAN BUS TECHNOLOGY	AUTOMOTIVE MEASURING TECHNOLOGY	BRAKE SYSTEM QUALIFICATION

SMART CITY

Intelligens közlekedési rendszerek

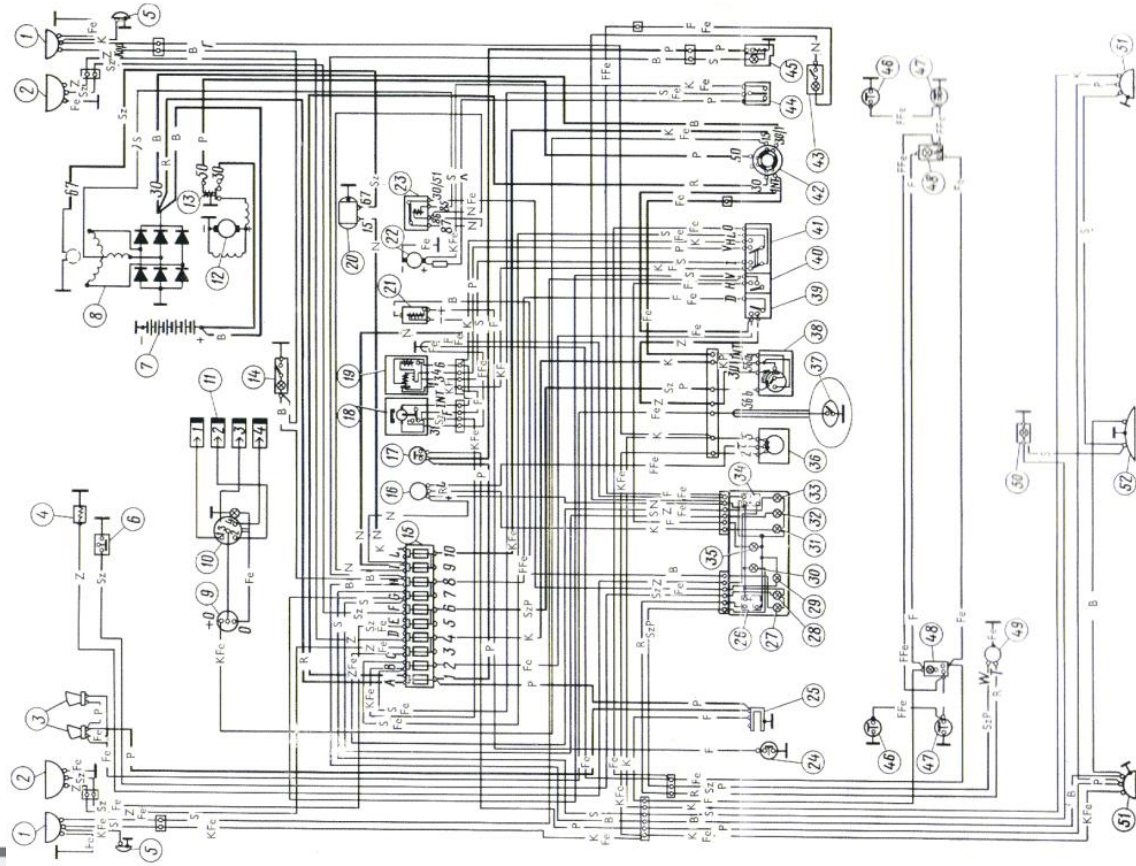| CAN Bus Technology DATA	CAN Bus Applications	CAR Hacking

CAN BUS TECHNOLOGY

DATA AVAILABILITY

CAN BUS SYSTEM
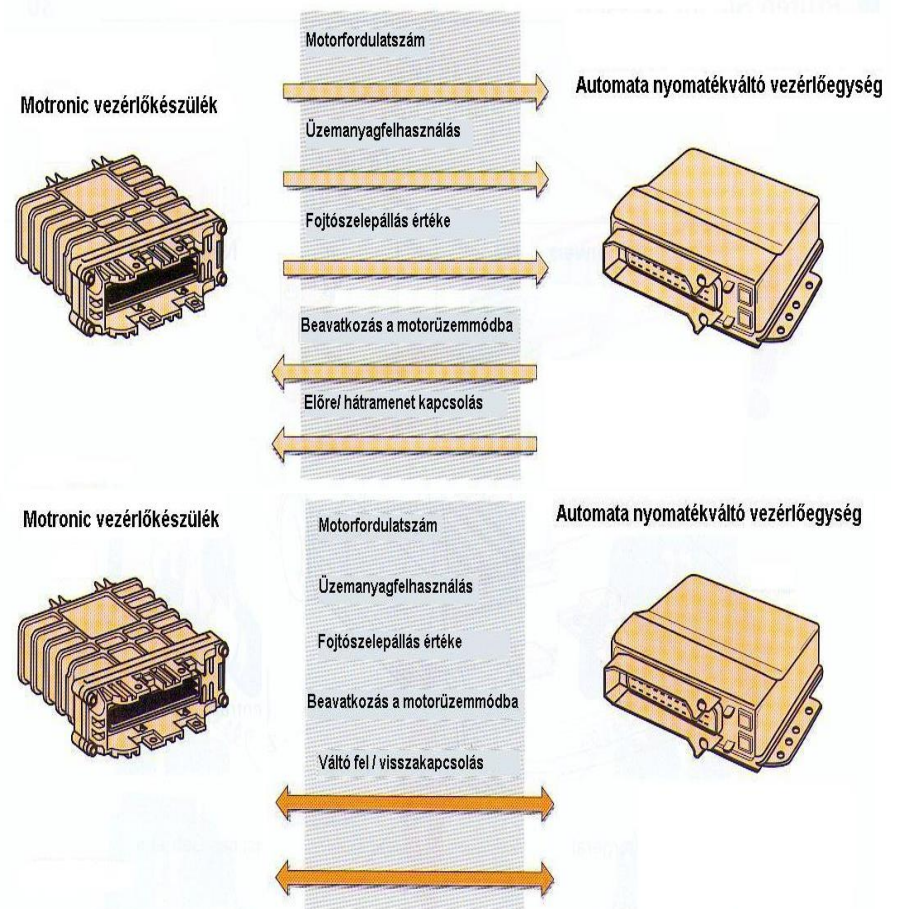
„OLD" VEHICLE ELECTRONIC SYSTEM

CAN BUS SYSTEM

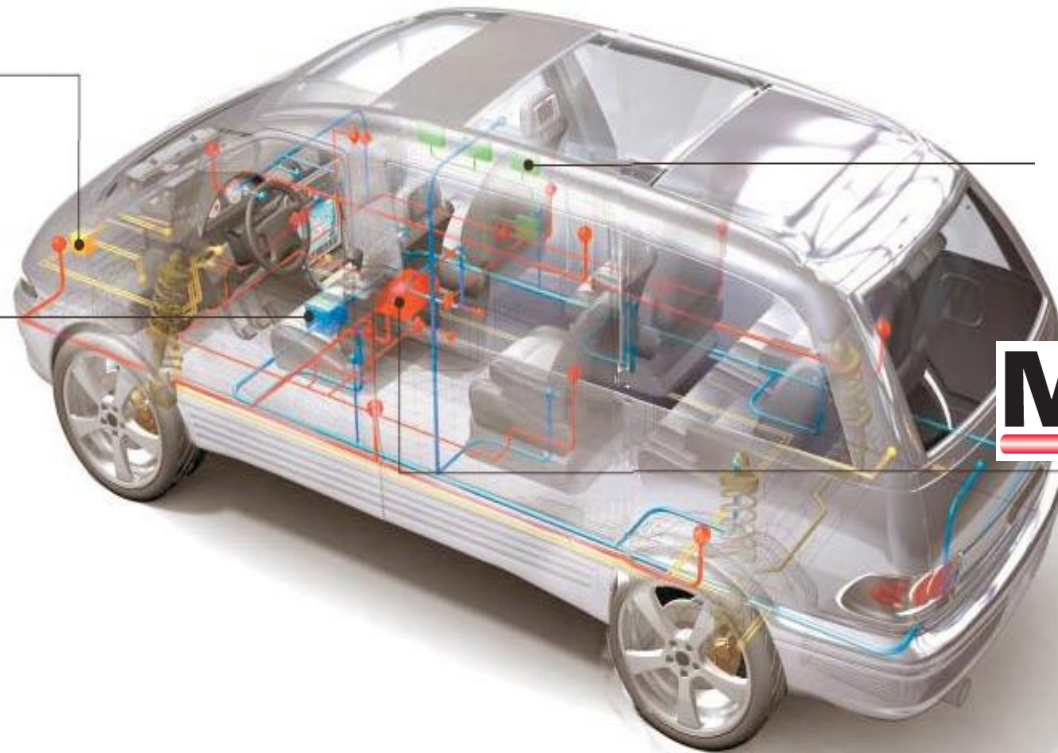## SERIAL BUS SYSTEMS

❑ Without BUS System

❑ With BUS system

COMPLEX VEHICLE ELECTONICS
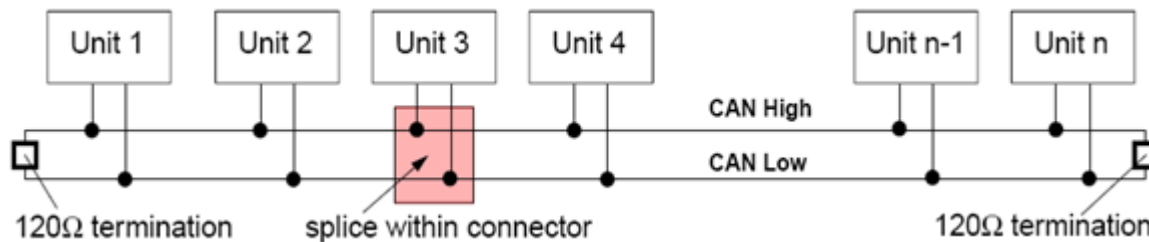
INTER- ECU COMMUNICATION SYSTEMS

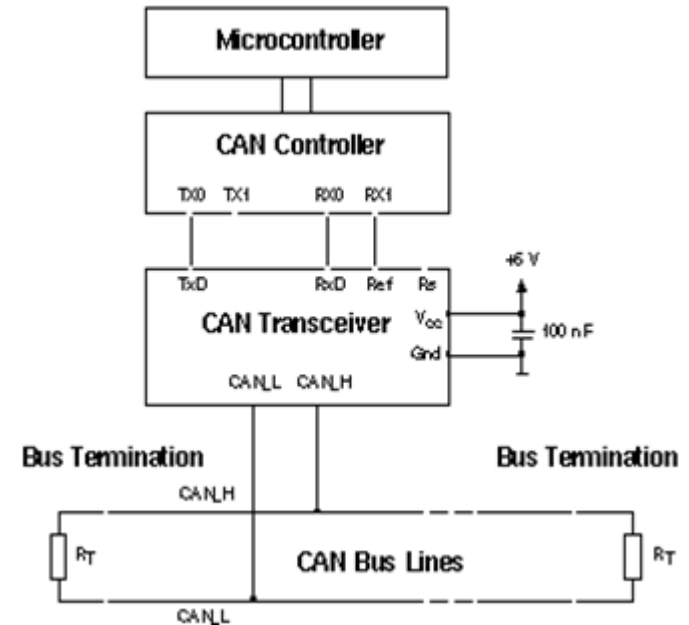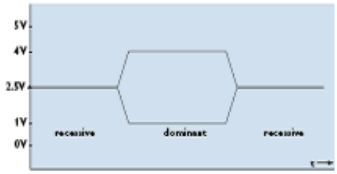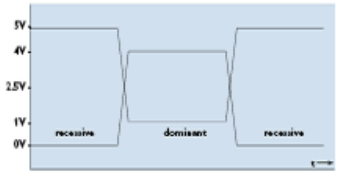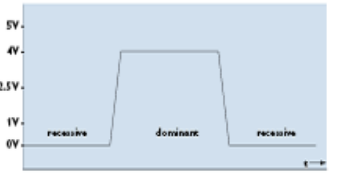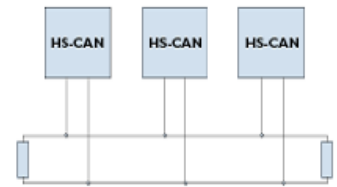# CAN BUS NODE / ECU
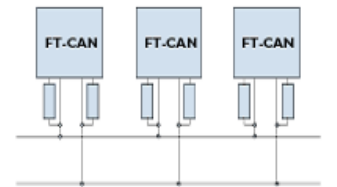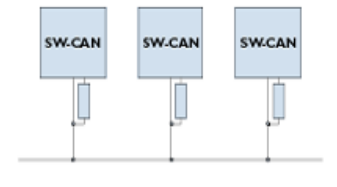
CAN PHYSICAL LAYER

CAN BUS NODE / ECU

CAN PHYSICAL LAYER

Features	HS-CAN	FT-CAN	SW-CAN
Data link layer standard	ISO 11898-1	ISO 11898-1	ISO 11898-1
Physical layer standard	ISO 11898-2	ISO 11898-3	SAE/J2411
Number of bus wires	2 (twisted pair)	2 (twisted pair)	1
Maximum bus speed	1 Mbits/s	125 kbits/s	33/41.6 kbits/s
Bus communication signal			
Bus termination principle			
Bus wire short-circuit and interrupt tolerance	limited short-circuit tolerance	tolerant against any single bus wire short or interrupt	no tolerance

DATA LINK LAYER – ARBITRATION – CSMA/CA
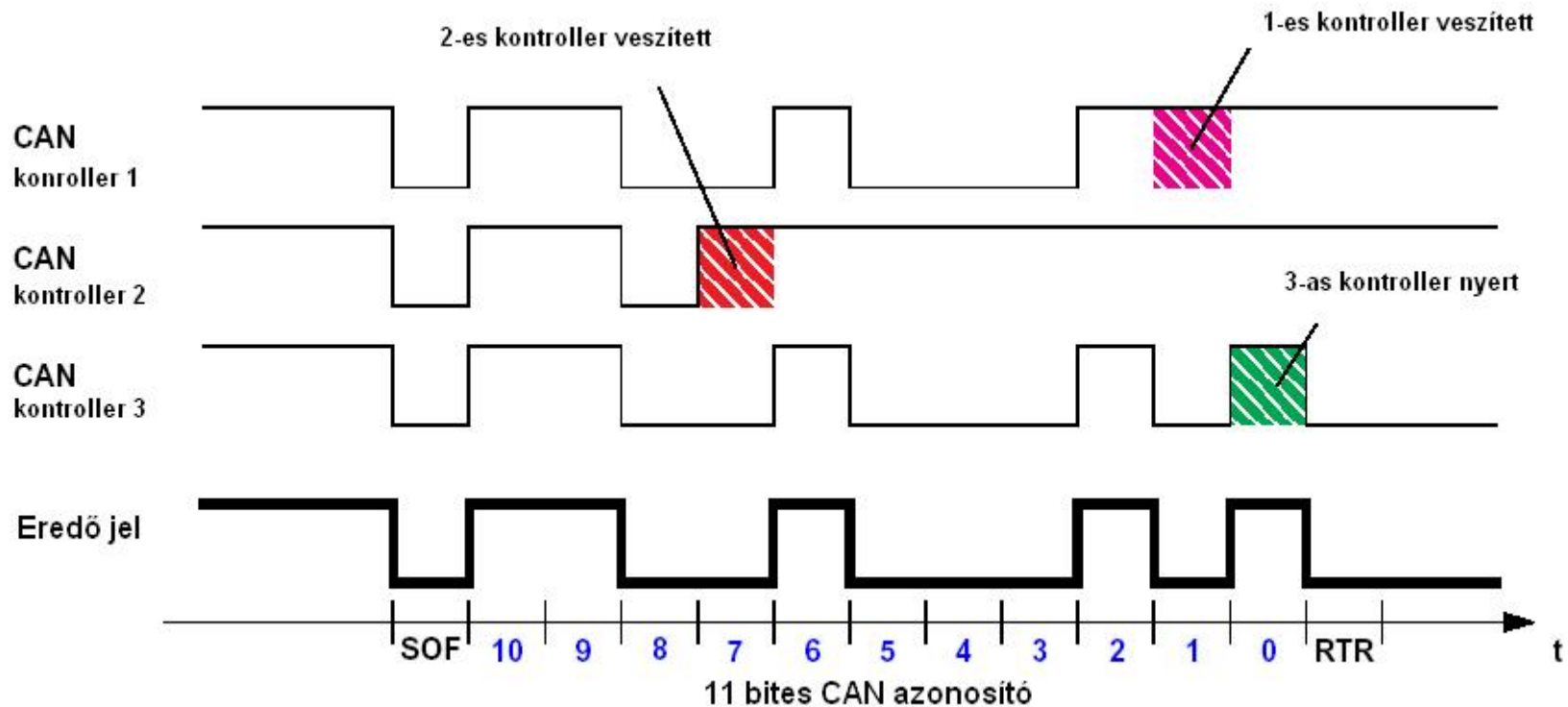
COMPLEX VEHICLE ELECTONICS

CAN BUS SYSTEM IN VEHICLES

- ❑ 11.136 electronic components
- ❑ 61 ECU
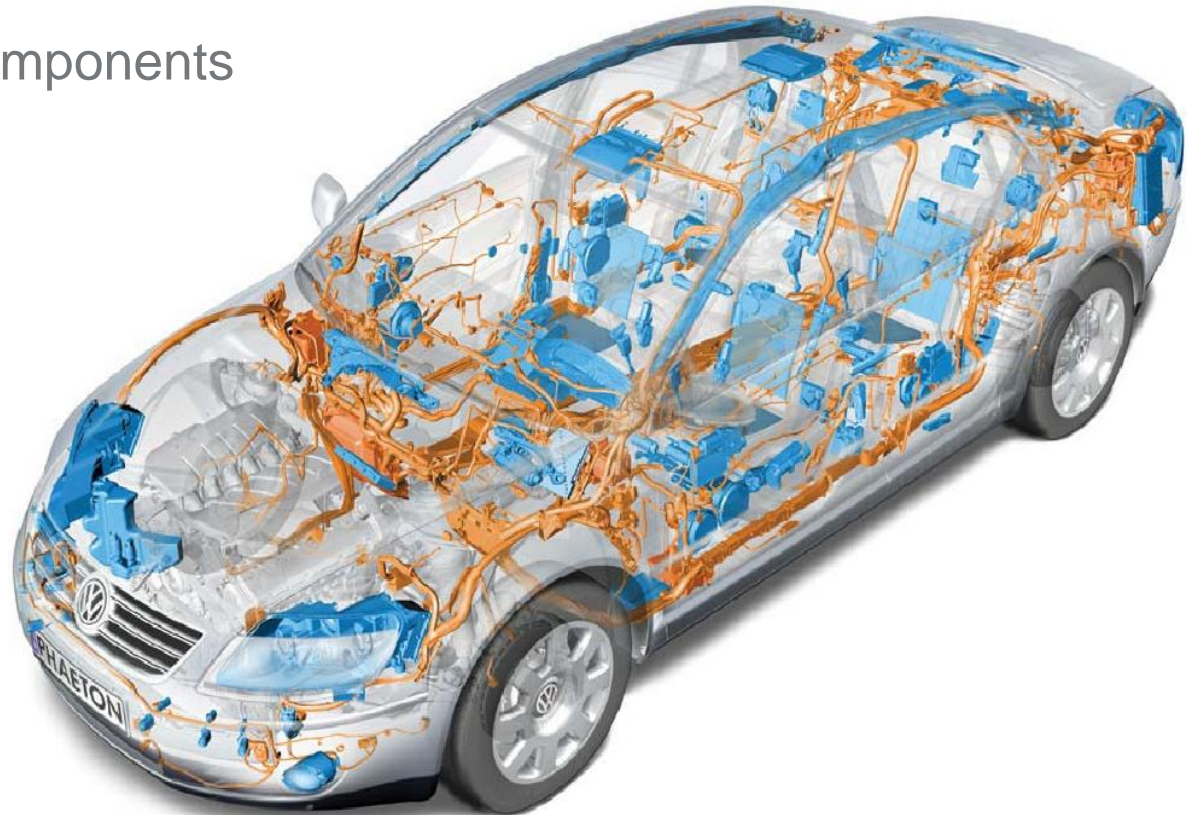- ❑ Up to 5 CAN bus
  - Powertrain
  - Comfort
  - Body - Chassis
  - Entertainment
  - Security
- ❑ 70 CAN msg/ bus
- ❑ 2500 signals

DATA FROM CAN BUS

- Odometer state
- Fuel used
- Fuel level
- Instatnaneous fuel usage
- Engine operation time
- Engine speed
- Engine coolant temperature
- Ambient Temperature
- Pedal status (3 pedals)
- Vehicle identification number
- Service distance

- Diagnostic Trouble Code
- Axle weight
- Tachograph data
- Trailer information
- Reefer information
- Door
- Alarm
- Windows
- Mirror
- Windscreen wiper

CAN BUS TECHNOLOGY

APPLICATIONS

FLEET MANAGEMENT SYSTEM
SYSTEM ARCHITECTURE IN TRUCKS
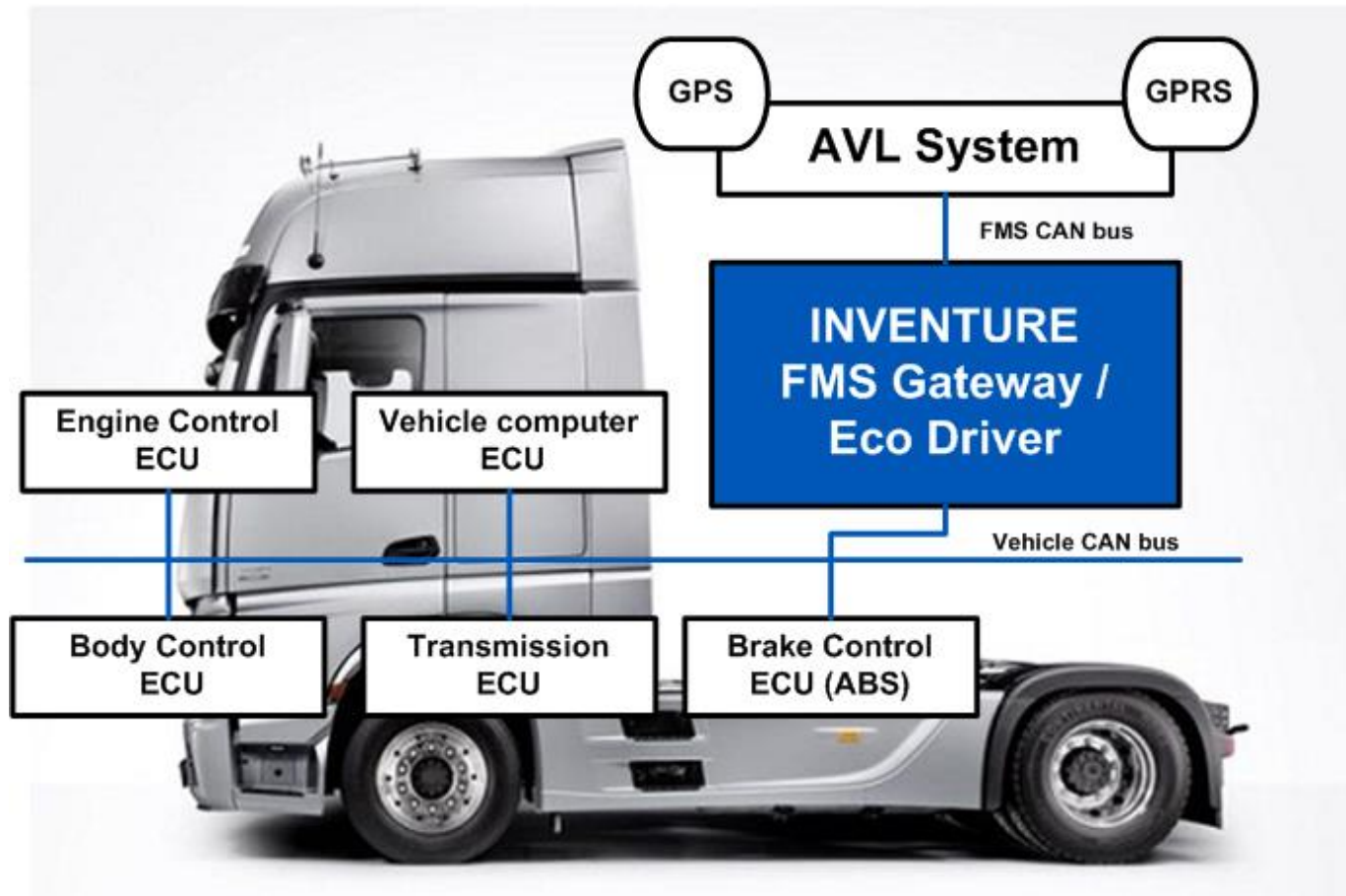
FMS GATEWAY™

OEM INDEPENDENT SOLUTION



- ❑ **600** Vehicle Models Supported
  - • Compatibility Matrix
- ❑ Output Data
  1. Standardized Data (FMS Standard)
  2. Extended Vehicle Technical Data
  3. Customer Specific Vehicle Related Technical Information

CONTACTLESS CAN ADAPTER

TO AVOID THE DISRUPTION OF CAN WIRES

- ❑ Signal sensing without Wire-to-Wire connection
- ❑ Inventure Technology
- ❑ No Vehicle Warranty Issues
- ❑ Easy installation
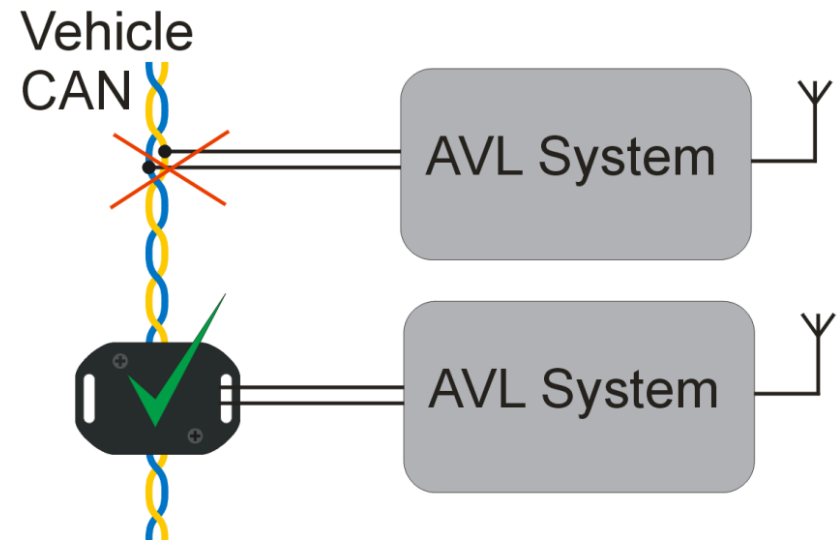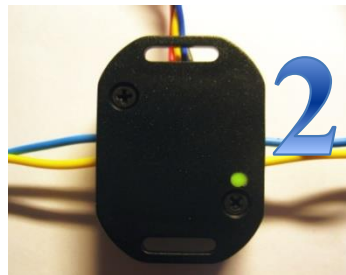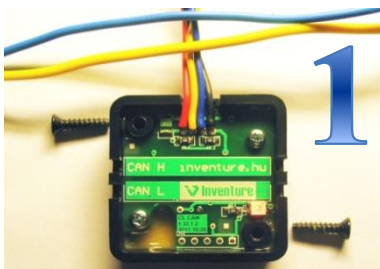
TACHOGRAPH INTERFACE

RELIABLE, REAL TACHOGRAPH DATA

❑ 15 Tachograph Data Provided

❑ RS232 output

including:

- Driver ID, Driver Name
- Continuous Driving Time
- Cumulative Driving Time
- Working states
- etc.

VDO, Stoneridge, ACTIA and EFKON DTCOs are supported

TRAILER INTERFACE

TRAILER INFO FROM THE EBS SYSTEM

❑ 25 Trailer Data Provided

❑ RS232 output

including:

- Trailer Axle Weight
- Trailer Distance
- VDC counter
- Tyre Pressure
- etc.

All Knorr-Bremse, Wabco and Haldex TCMs are are supported

ECO DRIVING TECHNOLOGY

Litre/100 km	Emergency	To Hospital	Other
Motorway	20,5	20,6	19,5
Highway	17,4	18,3	8,8
Suburbs	18,0	14,3	11,9
City	24,2	20,2	16,9

Reference: Porsche Hungaria

SPECIAL CAN BUS SOLUTIONS

WORKFLOW MONITORING

- Monitoring of Hydraulic System
  - Working process separation
  - Fuel consumption
  - Distance traveled
  - Engine hours
- Monitoring of salt spreader adapter
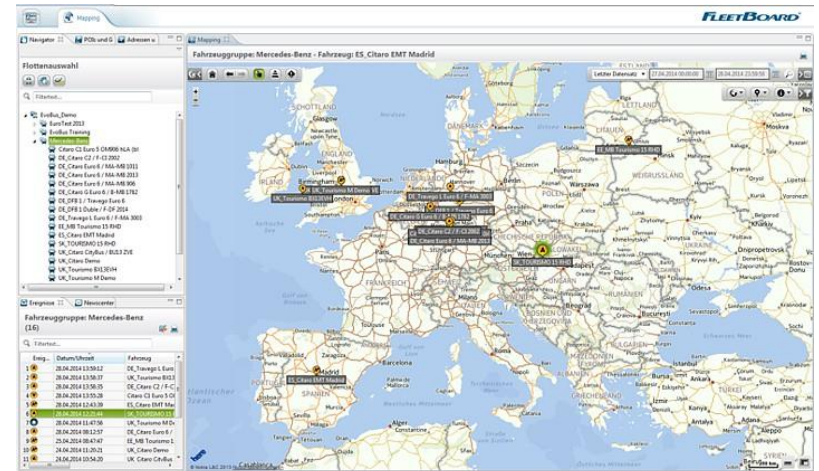 - Spreading Quantity
  - Spreading Width

TELEMATIC SYSTEMS

- ## FLEETBOARD
- ## TOMTOM OPTIDRIVE
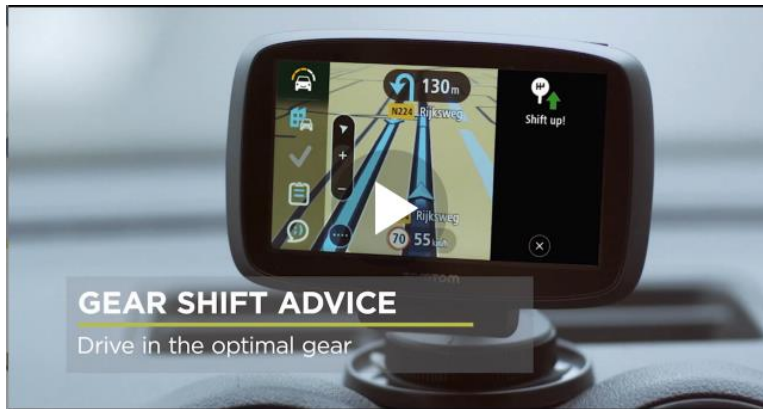
VISION: SUSTAINABLE ENVIRONMENT

❑ Operational Cost Reduction
- Fuel Usage Optimization / CO_2 reduction
- Preventive Maintenance

❑ Enhance Vehicle Safety
- Journey Risk Management
- Eco-Driving
- Use Based Insurance

- Connected Car techology

CONNECTED CAR

- Purchase oriented solutions
- eCall system
- Car-sharing, EV charging network
- Live traffic map (Waze, maps.Google)
- Safety oriented solutions (ABS activity, road temperature)
- OEM built-in features, applications (Wi-Fi HS)
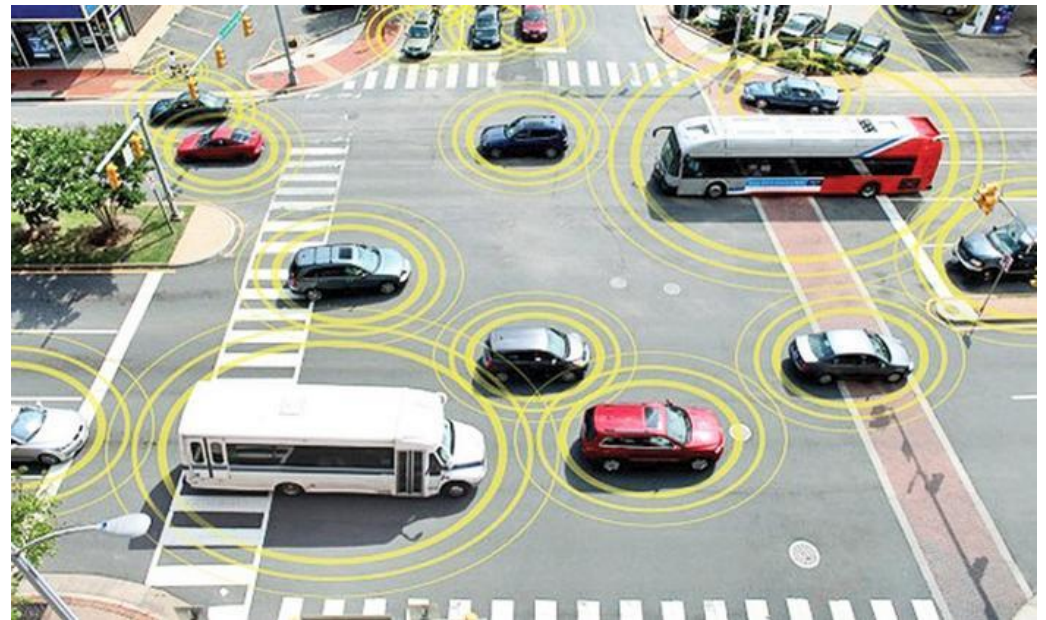
INTELLIGENT SUBSYSTEMS

CURRENT FEATURES

- ❑ Lane Departure Warning System/Lane Assist
- ❑ Adaptive Cruise Control
- ❑ Hill-holder
- ❑ Adaptive Lights
- ❑ City Brake Assist
- ❑ Parking Assist
- ❑ X-by-Wire
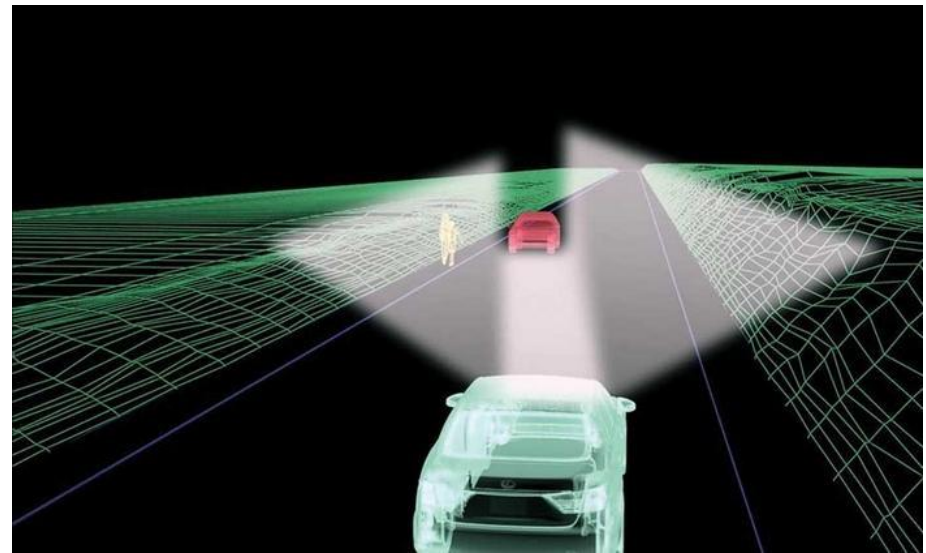
SELF-DRIVING CARS

WILL ARRIVE, BUT NOT NOW

- ❑ Tesla Model S, Google, Volvo
- ❑ Legal issues
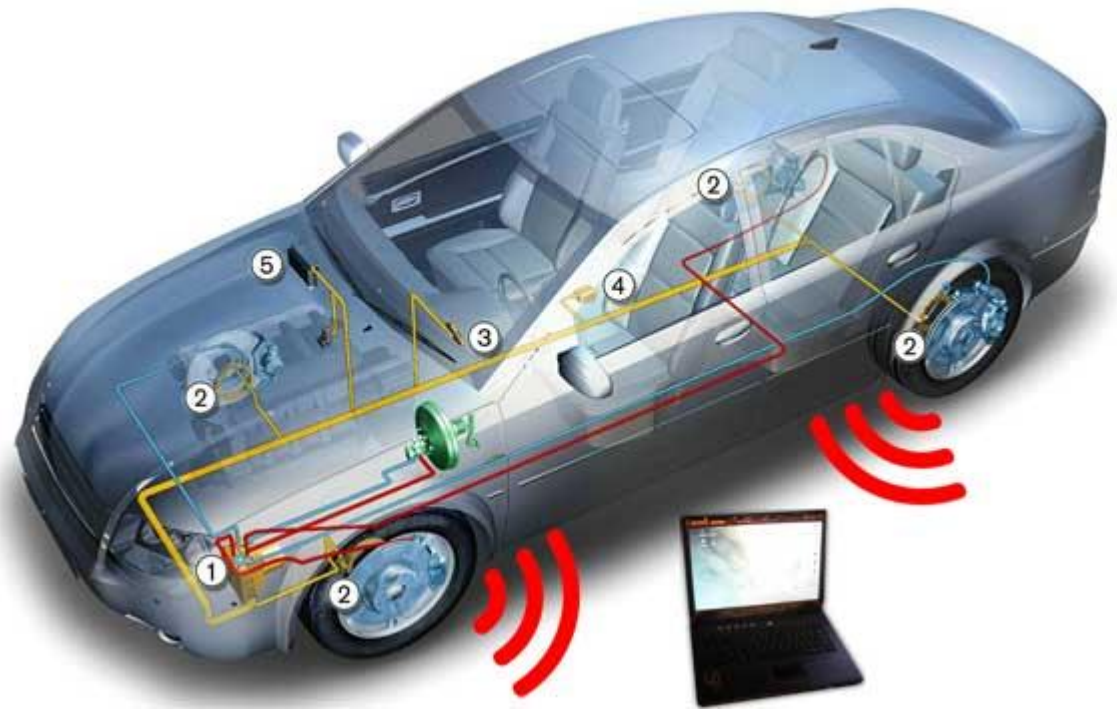- ❑ V2V/V2I comm.
- ❑ Car hacking

CAR HACKING

CAR HACKING

VEHICLE CONTROL WITH HACK TOOLS

❑ Remote attacks
❑ Vehicle is On-line
- Bluetooth
- Wifi
- INTERNET !!!
❑ Vehicle control
- Steering
- Acceleration
- Alarm
- Central lock
- Brake system

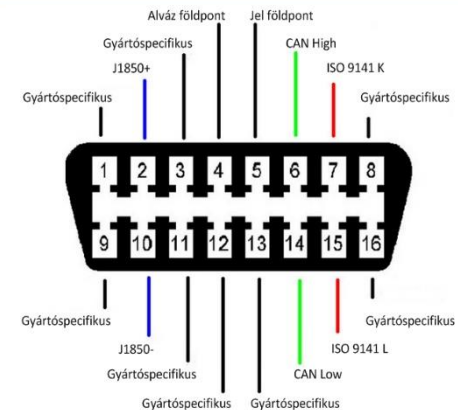# CAR HACKING METHODS

HOW TO HACK A CAR

❑ Diagnostic port (Off-Line)
(On-Board Diagnostics - OBD)

- Galvanic connection
- Diagnostic Tool + laptop

❑ Internet connection (On-Line)

- ECU software update
- Remote CAN messages

CAR HACKING OFF-LINE

„STUXNET"

PC running WinCC PLC management software

PLC controlling the uranium centrifuges

uranium centrifuges

❑ CrySyS Lab

PC running a vehicle diagnostic software

ECU controlling some function of the vehicle

vehicle

CAR HACKING - VEHICLE SIMULATOR

FOR BUDAPEST UNIVERSITY OF TECHNOLOGY

- ❏ Moving Road-vehicle Mode
- ❏ Simulator Modes
  - ❏ Sensor Test, Demo Mode
  - ❏ Autonomous Simulation (uC)
  - ❏ PC Simulation
    - ❏ CarSim in Matlab environment
    - ❏ Complex, validated physical models
    - ❏ Real-time graphical display
    - ❏ Full driving experience

http://www.youtube.com/watch?v=Wa7vpGFDLYQ
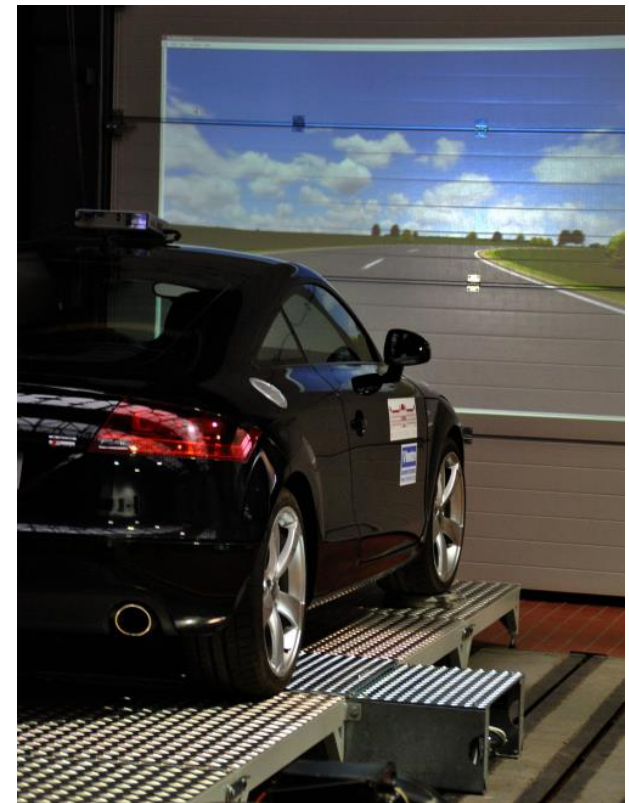
CAR HACKING

ON-LINE

- ❑ Charlie Miller
- ❑ Chris Valasek

- ❑ Toyota Prius & Ford Escape 2012 - Forbes
- ❑ Jeep Cherokee 2015 - Wired

FUTURE DEVELOPMENTS

❑ Zalaegerszeg - Autonomous test track (35 billion Ft)

- Car
- Truck
- Bus

❑ OEM independent

❑ High speed track (2020)

❑ ThyssenKrupp
❑ AdasWorks

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THANK YOU FOR YOUR ATTENTION