

POLLUX



Distributed real time embedded systems for next generation electric vehicles architectures

Joint EC / European Green Cars Initiative Clustering Event 2012

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11 July 2012, Brussels, Belgium

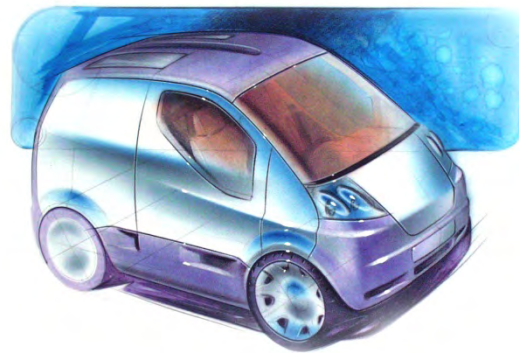
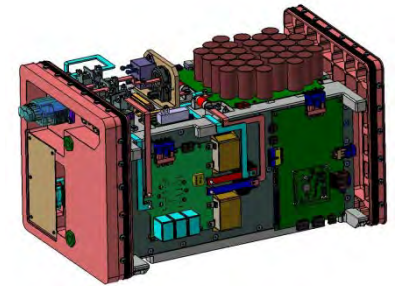
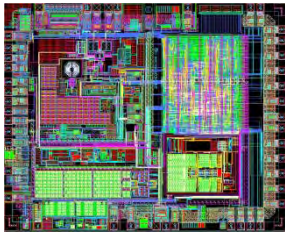


Advanced Research & Technology for Embedded Intelligence and Systems

ARTEMIS POLLUX



► Process Oriented Electronic Control Units for Electric Vehicles Developed on a multi-system real-time embedded platform.



Source: DuraCar



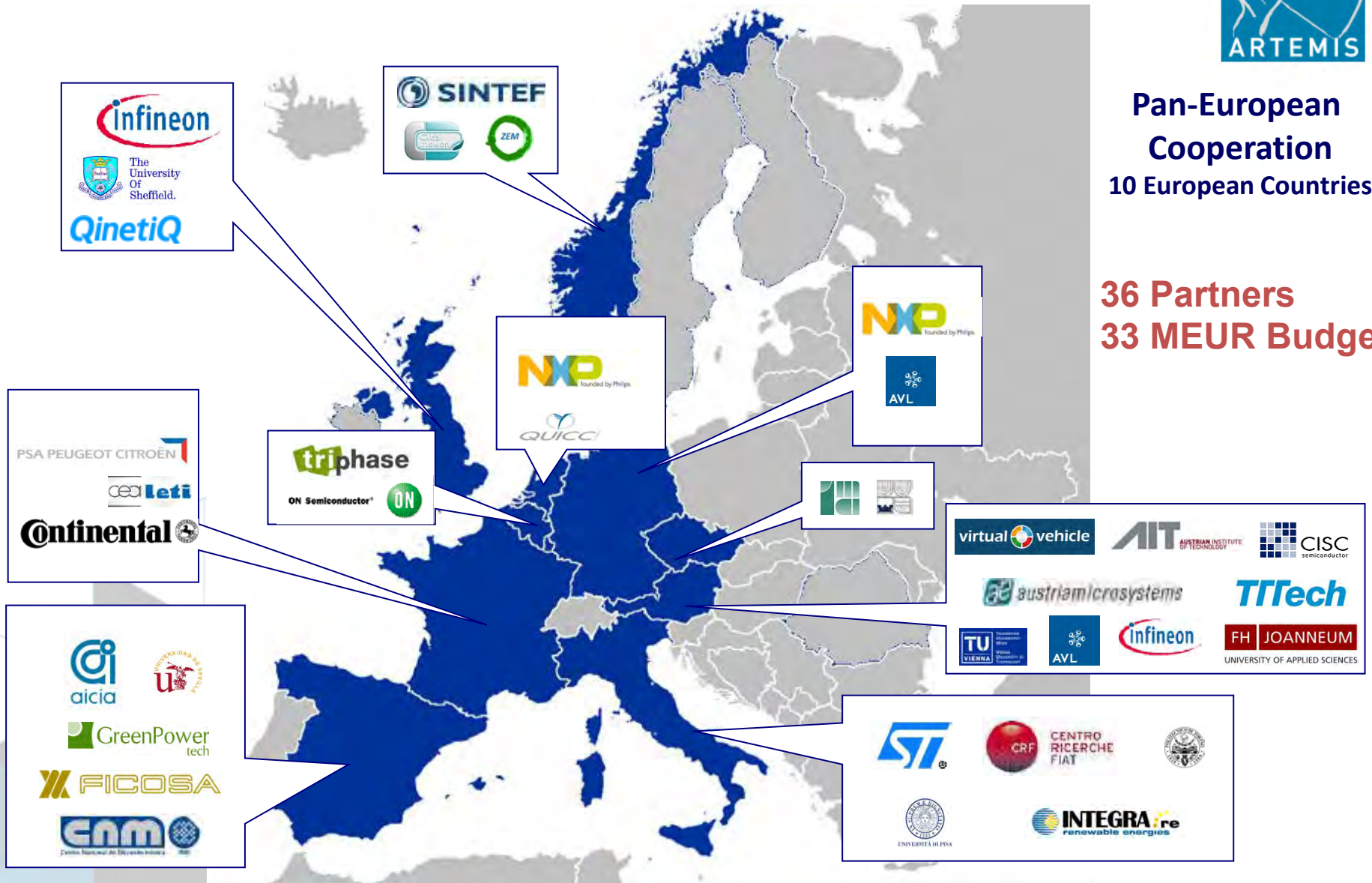
Source: Trexa

ARTEMIS POLLUX - Consortium

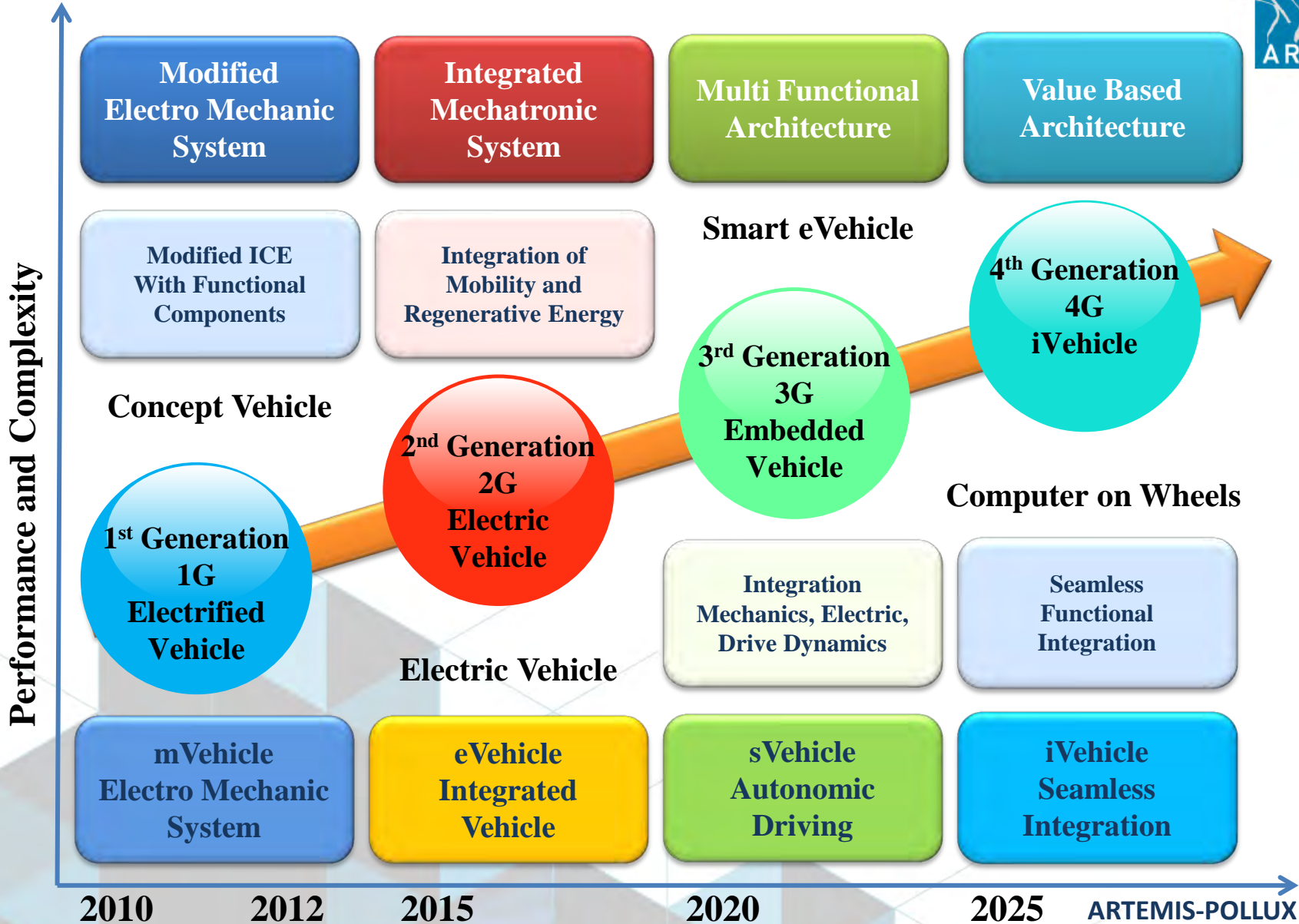


**Pan-European
Cooperation**
10 European Countries

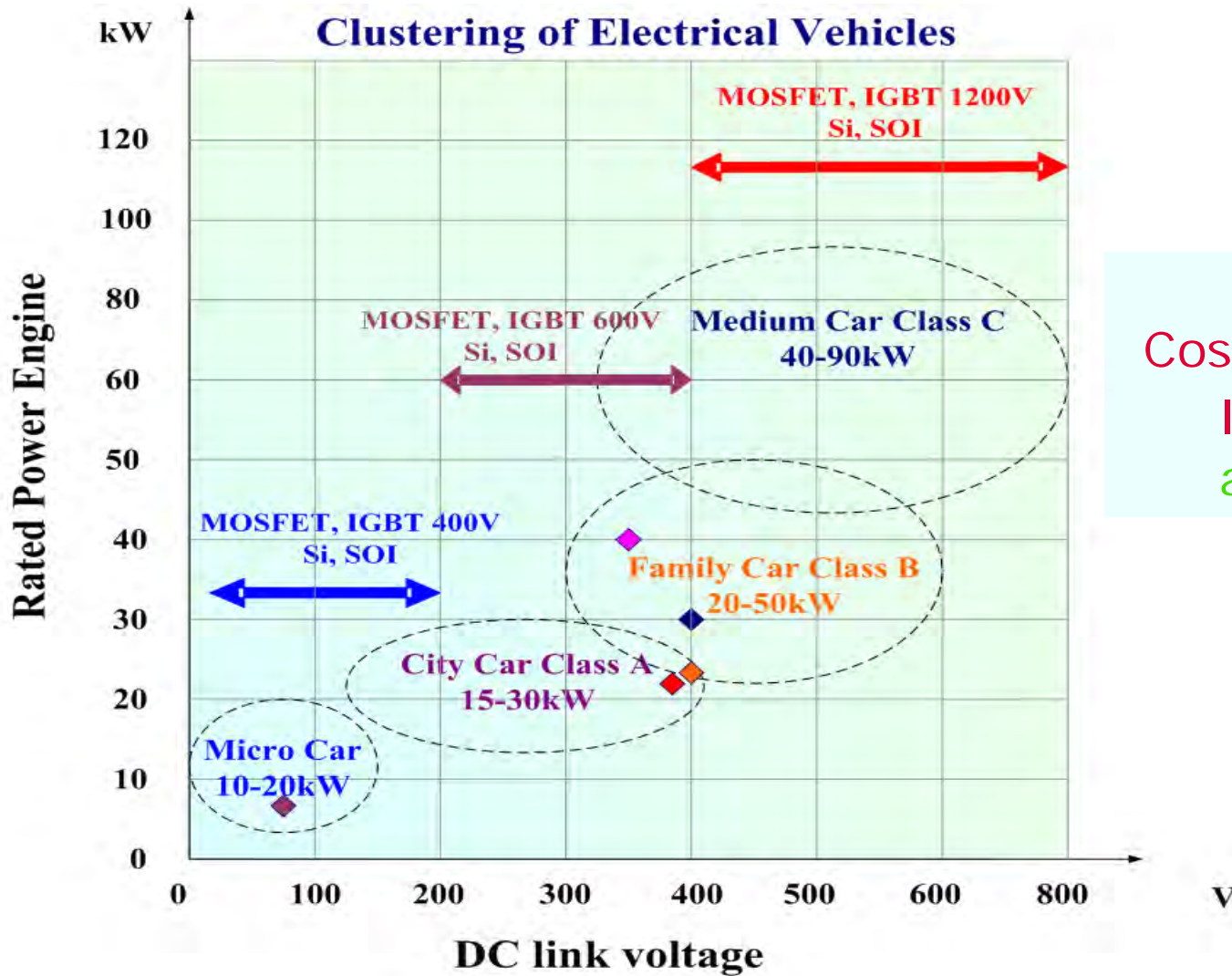
36 Partners
33 MEUR Budget



Electric vehicle generations



EV Class vs Semiconductor



$P = U \times I$
 Cost_{semiconductor} = f(I)
 If P ↑ then U ↑
 also Eff = f(U)

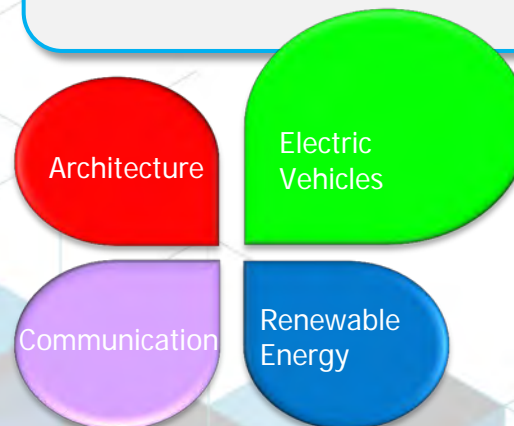
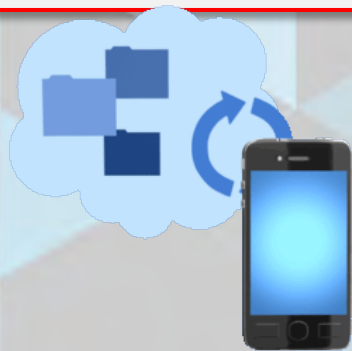
ARTEMIS POLLUX- Objectives



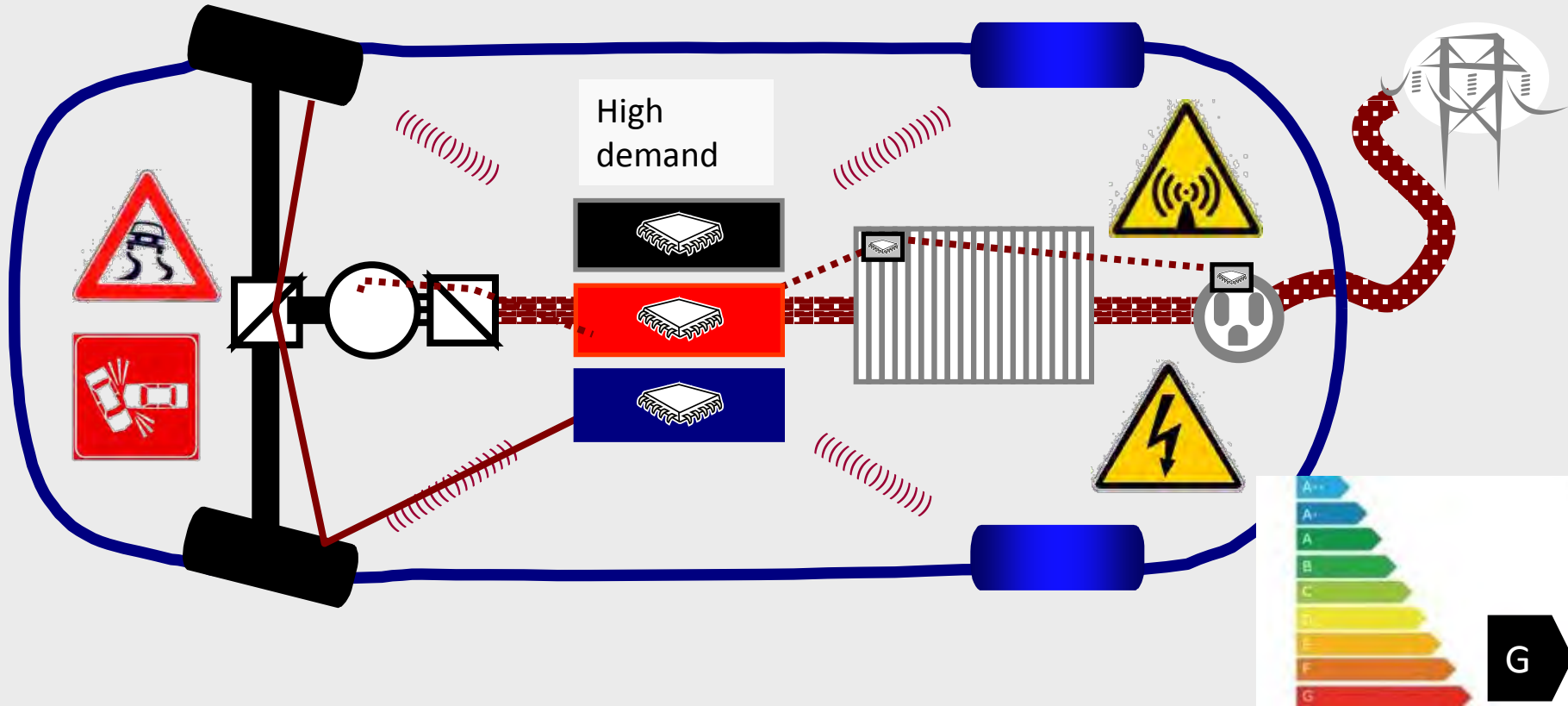
Develop a distributed real time embedded systems (ESs) platform for next generation electric vehicles, by using a component and programming-based design methodology. Reference designs and ESs architectures for high efficiency mechatronics systems





POLLUX addresses the embedded system needs for the next generation electric vehicles by exploiting the synergy with the ENIAC E³Car project which developed nanoelectronics technologies, devices, circuits, and modules for EVs.

POLLUX considers both vertical integration and horizontal cooperation
Goal: build a solid, embedded-systems European industry while establishing standard designs and distributed real-time embedded-systems platforms for EVs.



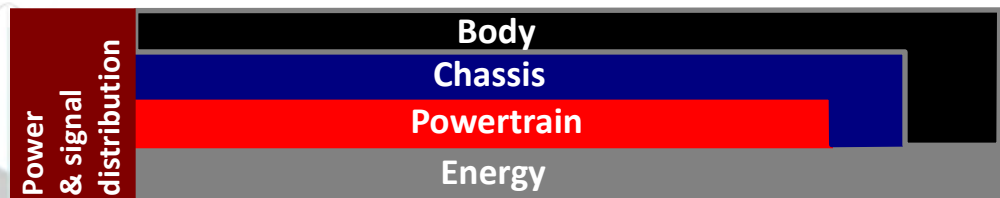
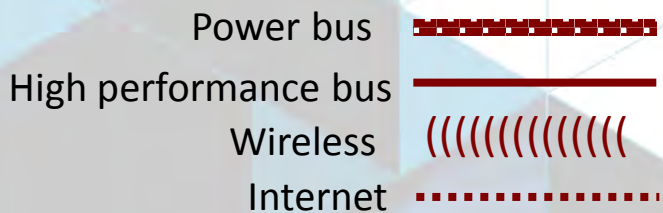
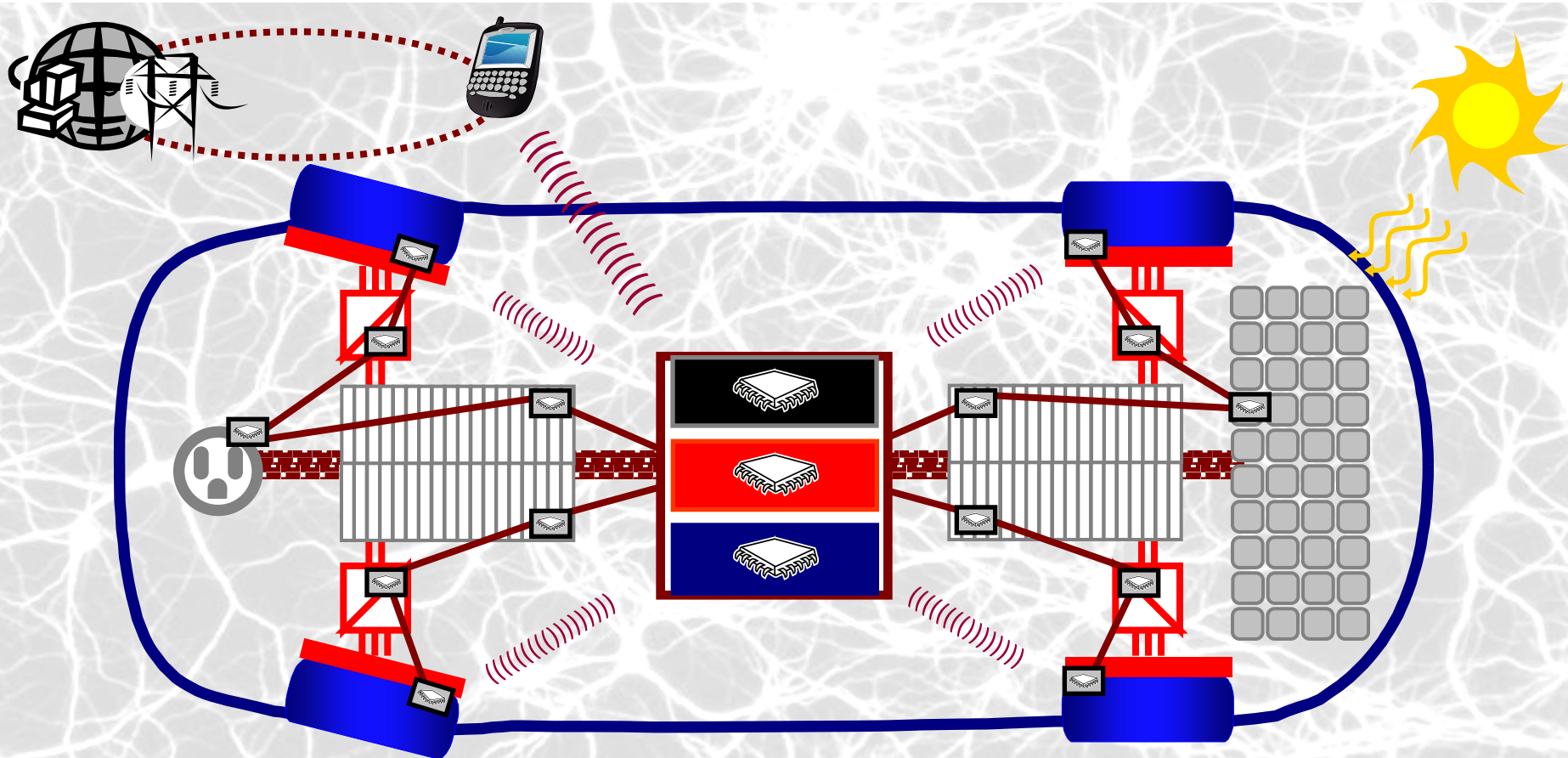
Conventional EV architecture



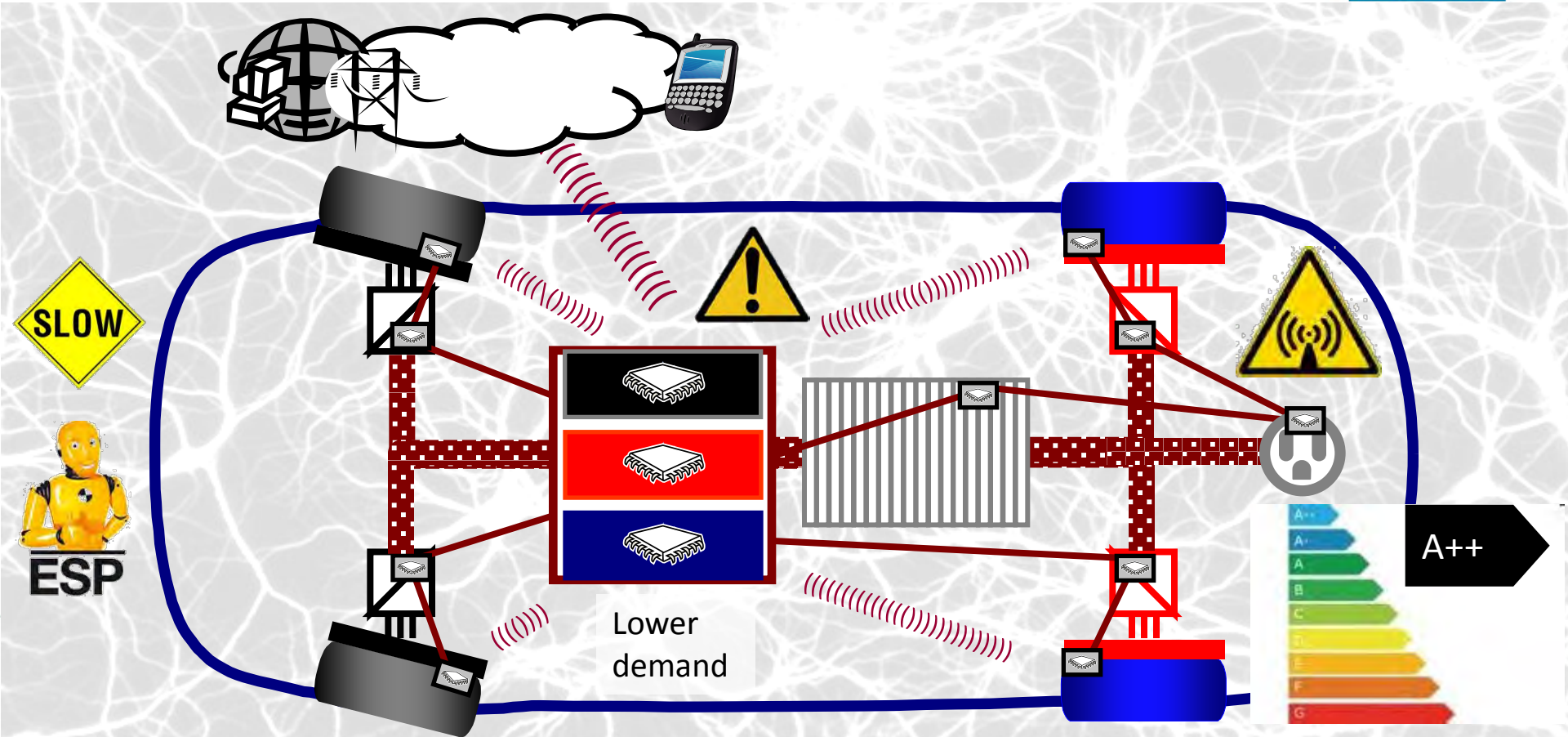
- Power bus 
- High performance bus 
- Wireless 
- Can Bus 







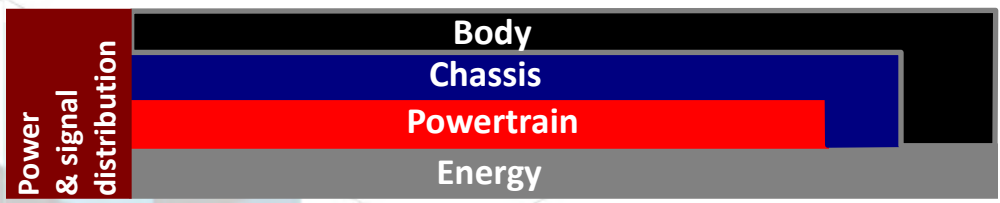
Distributed powertrain architecture



Distributed propulsion



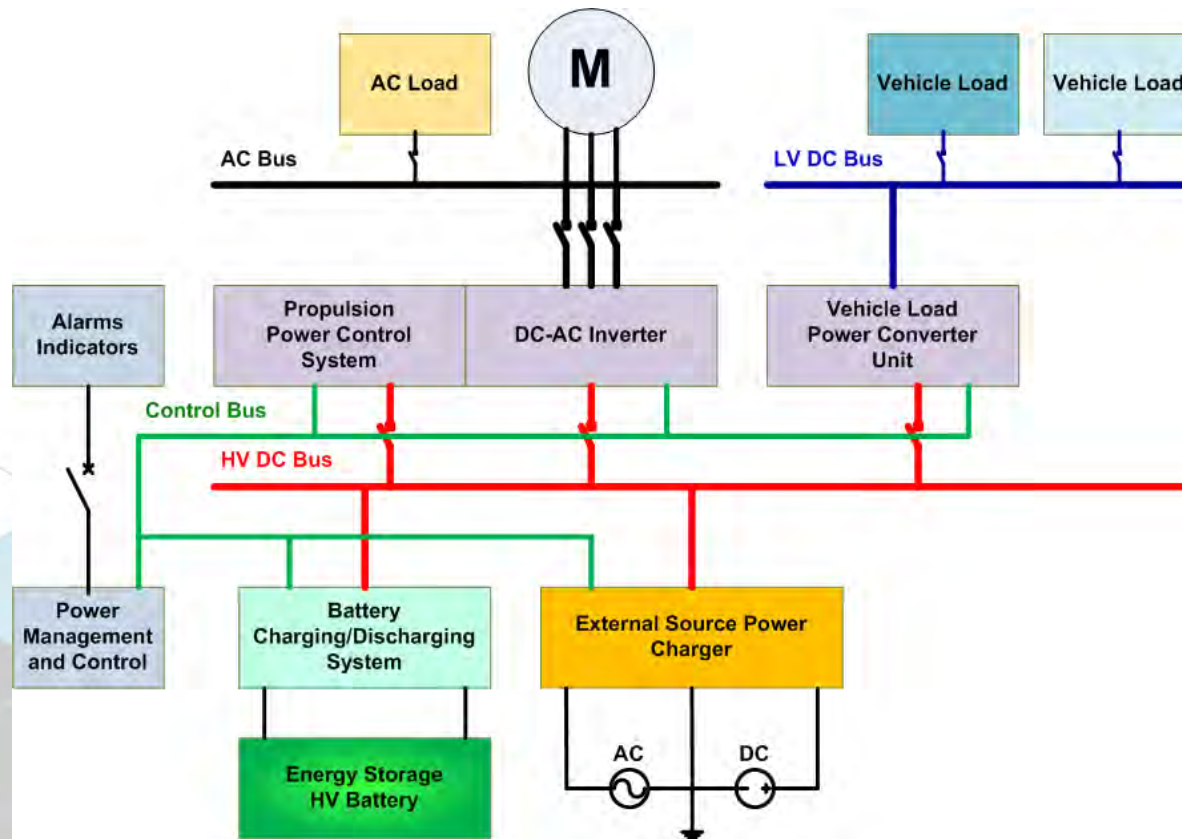
Power bus 
 High performance bus 
 Wireless 
 Internet 



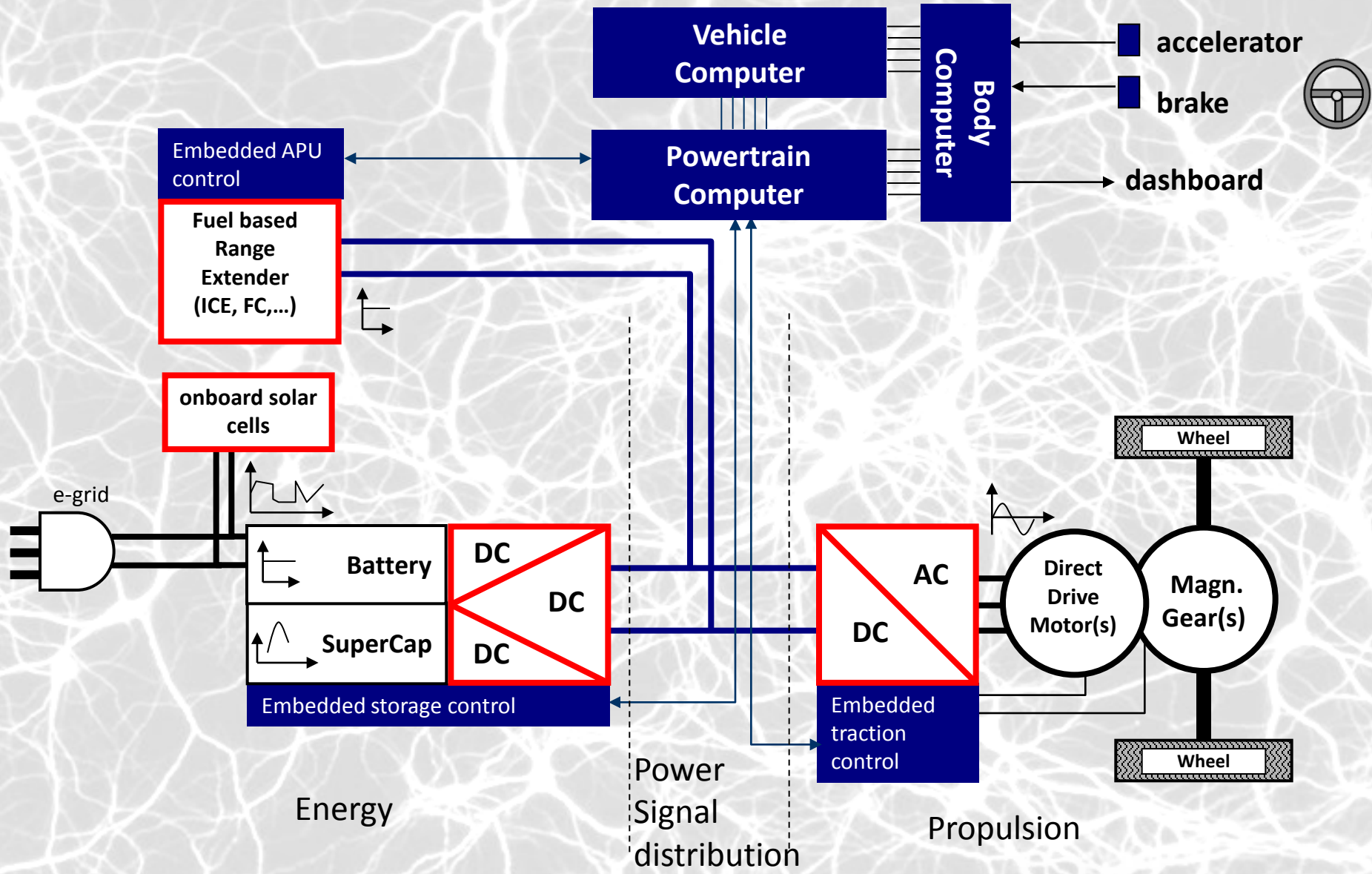
EV Architecture



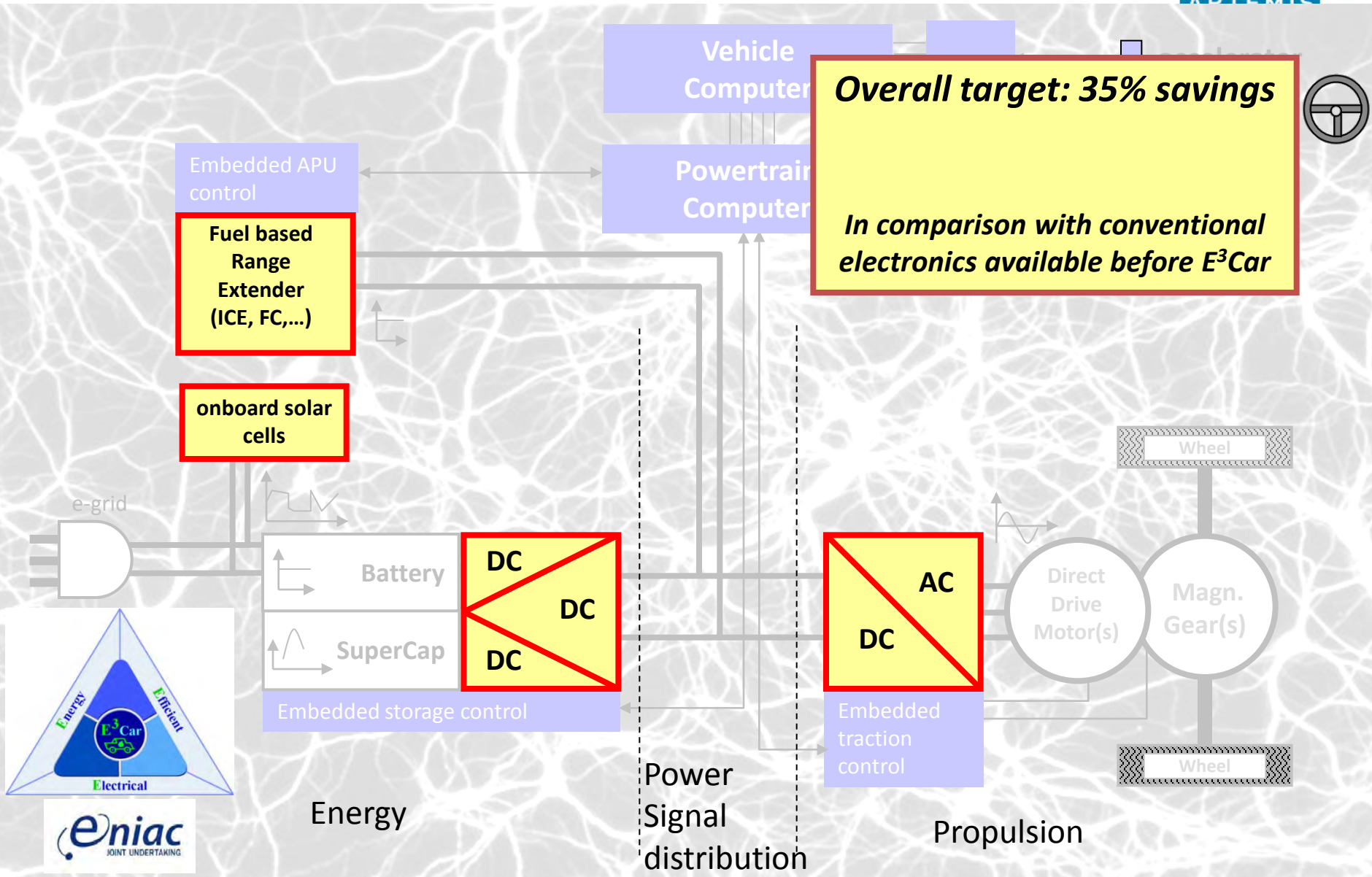
► Power architecture for an electric vehicle



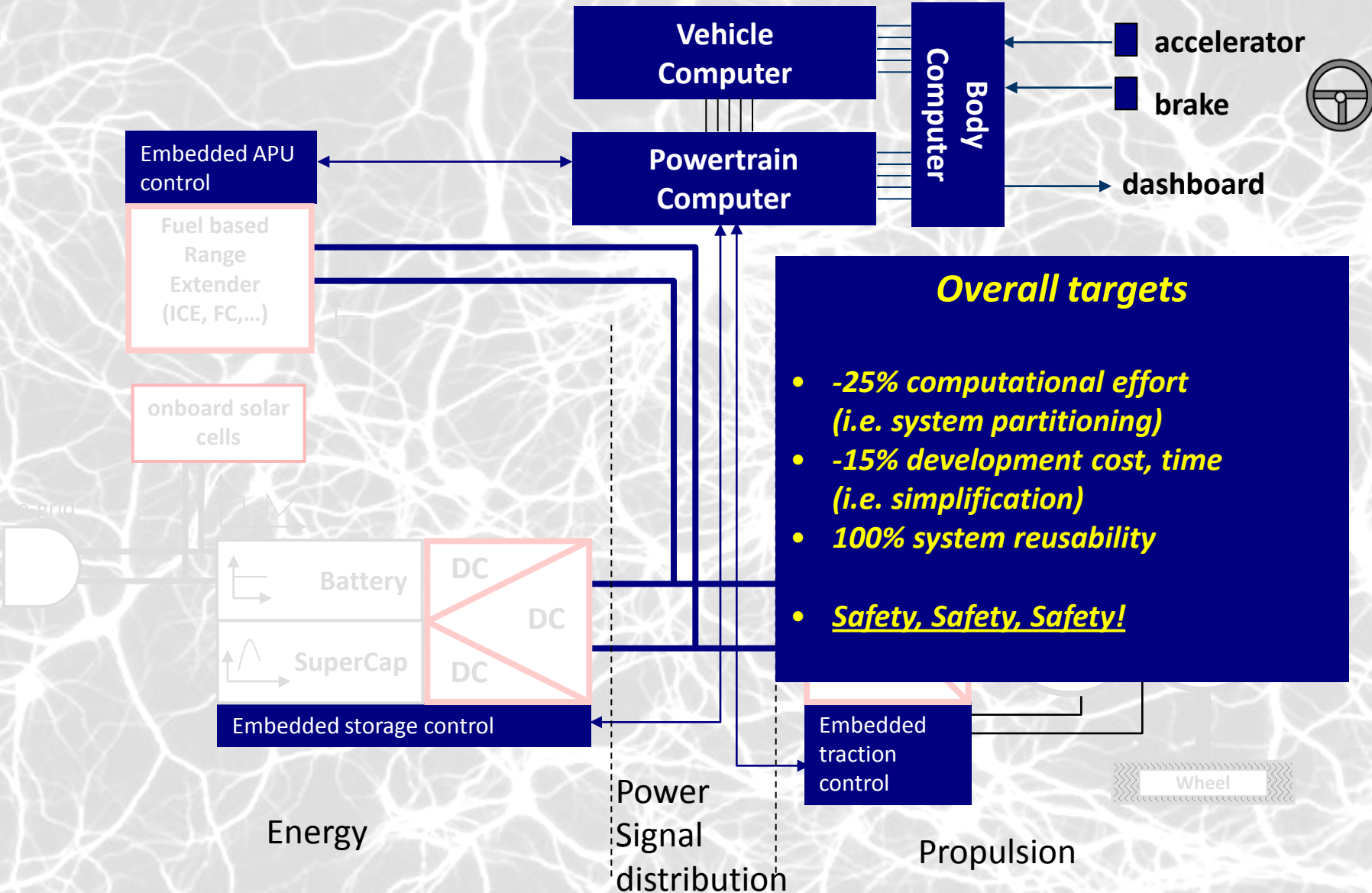
EV Architecture - Electric powertrain



Powertrain efficiency (ENIAC-E³Car)



Powertrain architecture - POLLUX



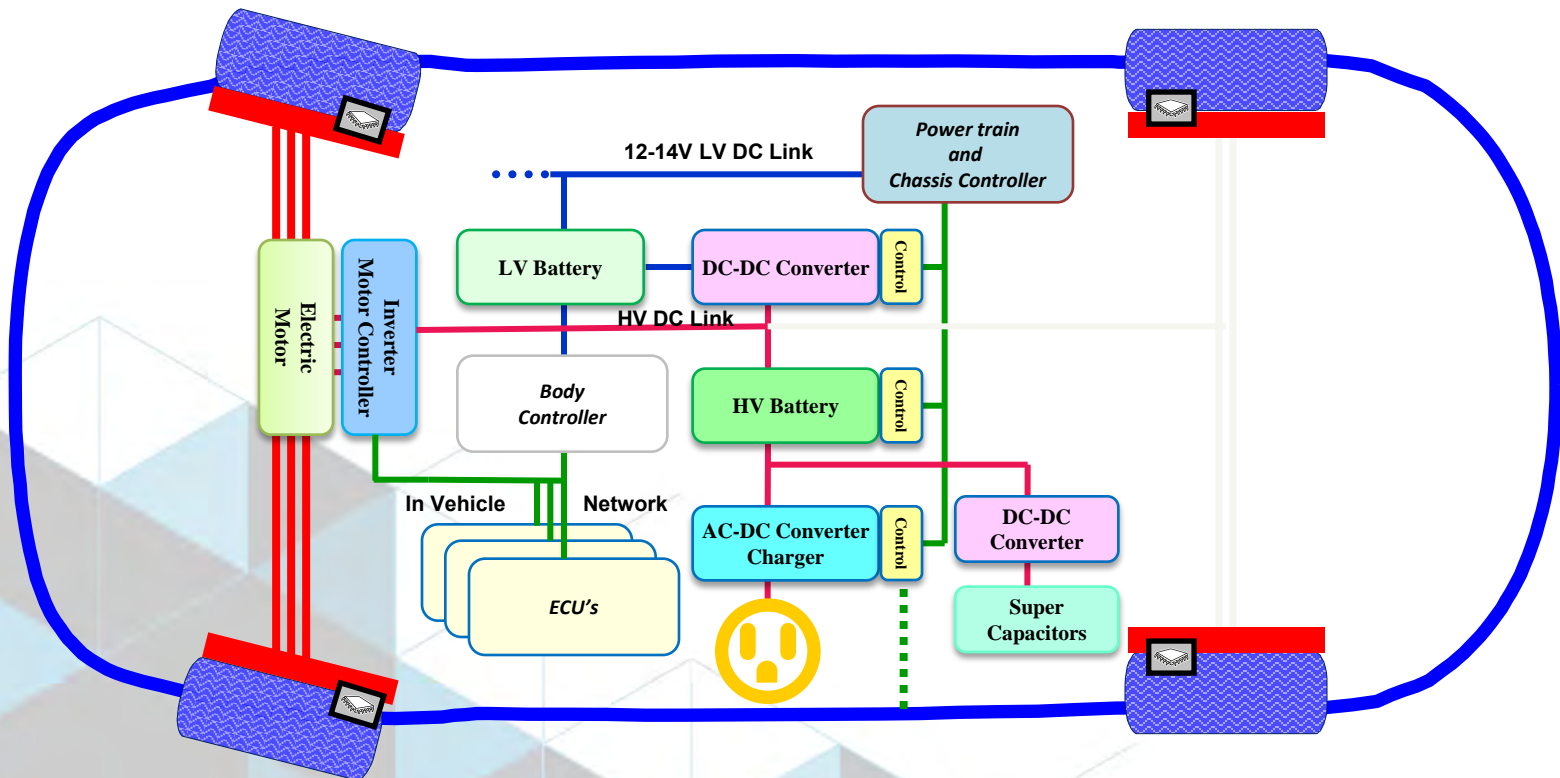
Overall targets

- *-25% computational effort (i.e. system partitioning)*
- *-15% development cost, time (i.e. simplification)*
- *100% system reusability*
- **Safety, Safety, Safety!**

EV Architecture



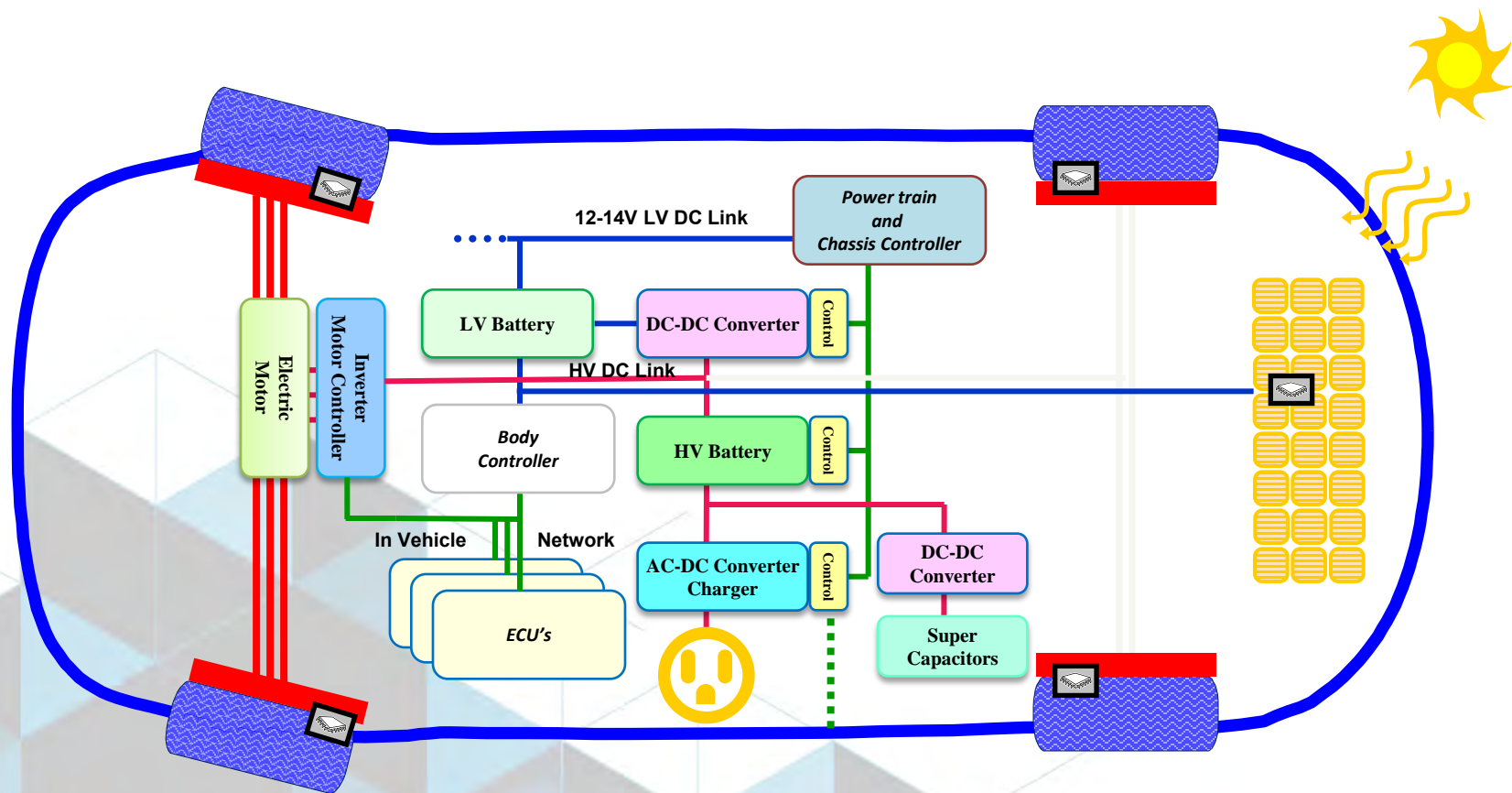
No of electric motors: 1
Main batteries & super capacitors



EV Architecture



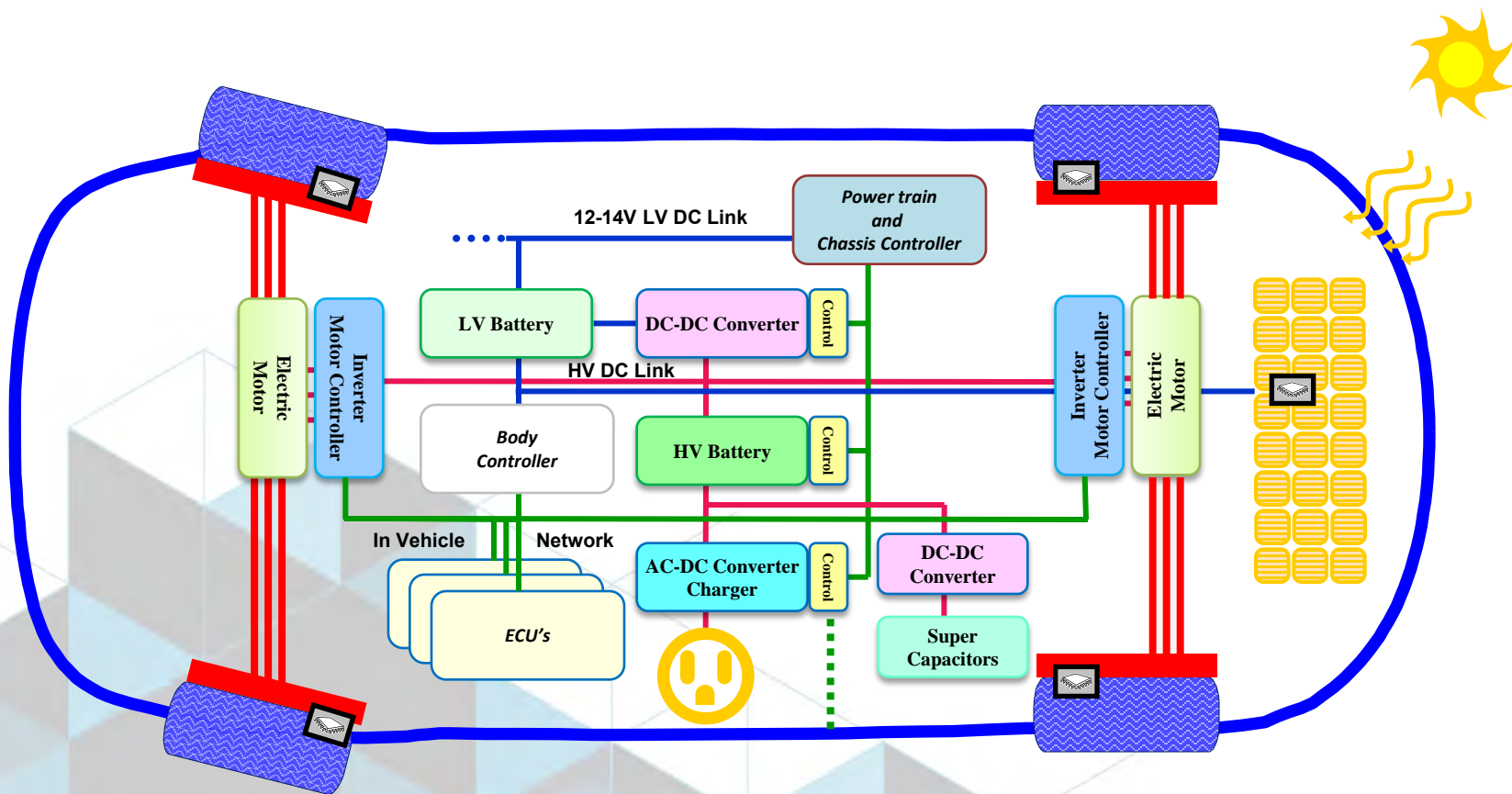
No of electric motors: 1
Main batteries, super capacitors & solar cells



EV Architecture



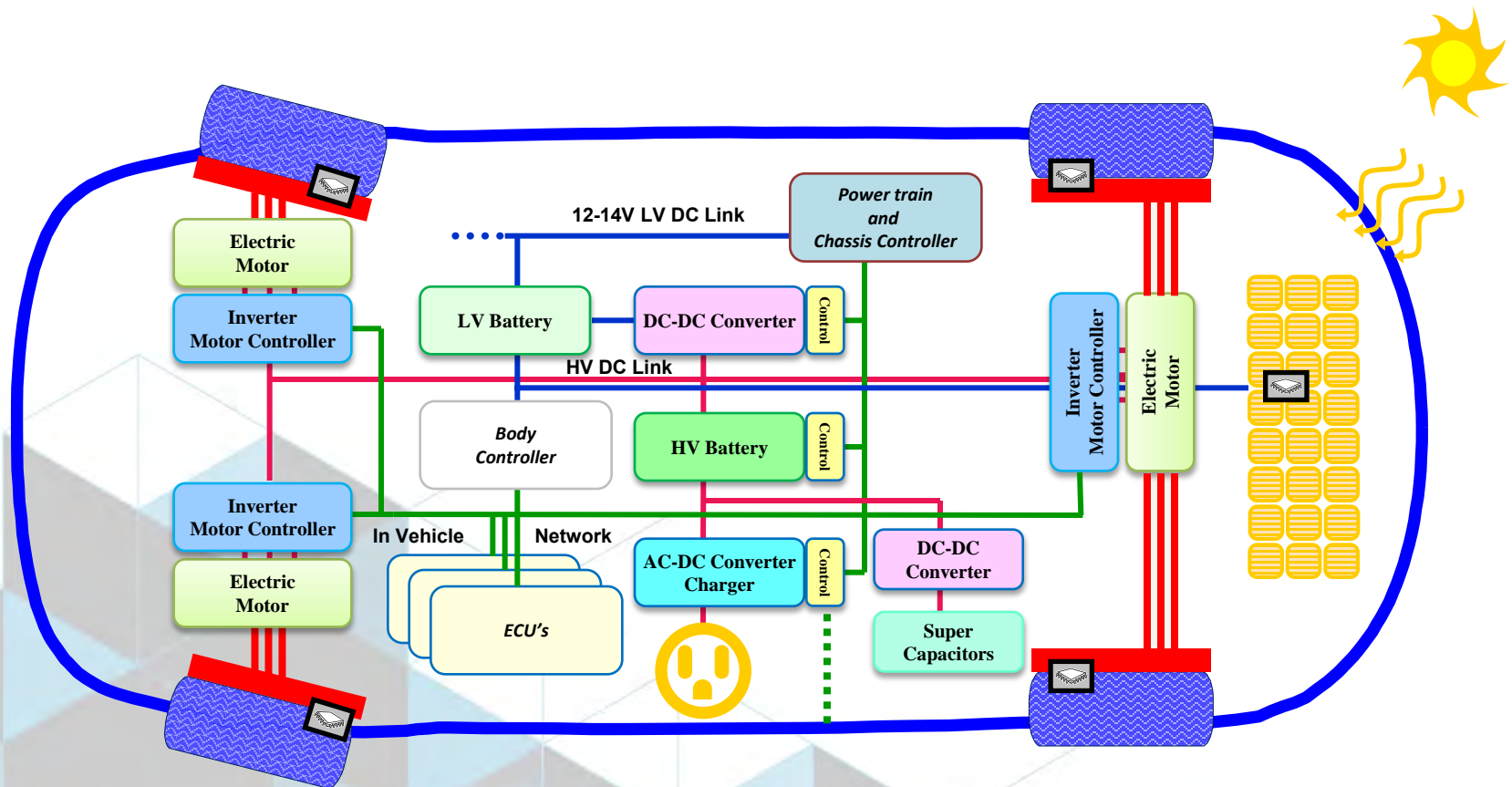
No of electric motors: 2
Main batteries, super capacitors & solar cells



EV Architecture



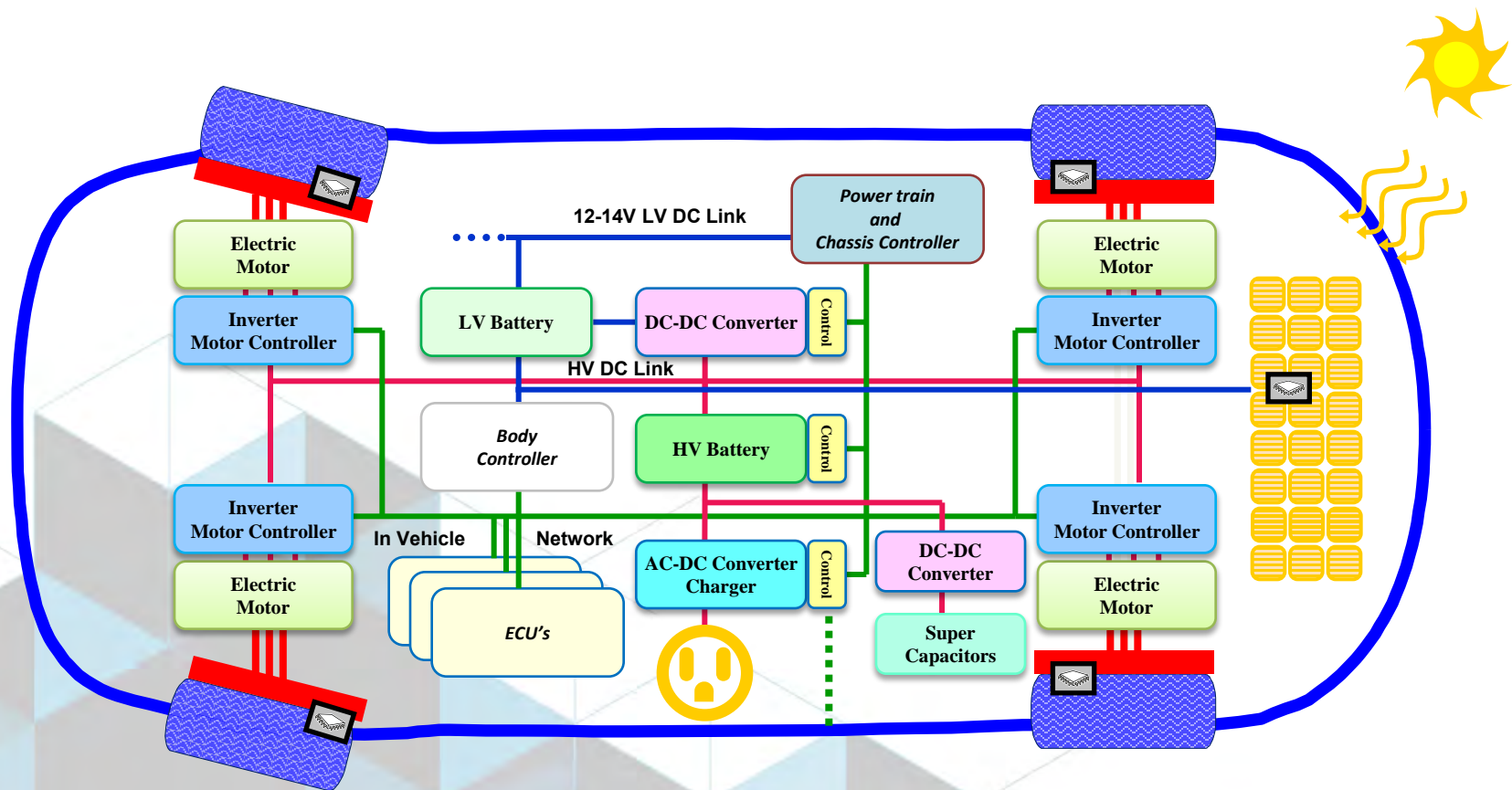
No of electric motors: 3
Main batteries, super capacitors & solar cells



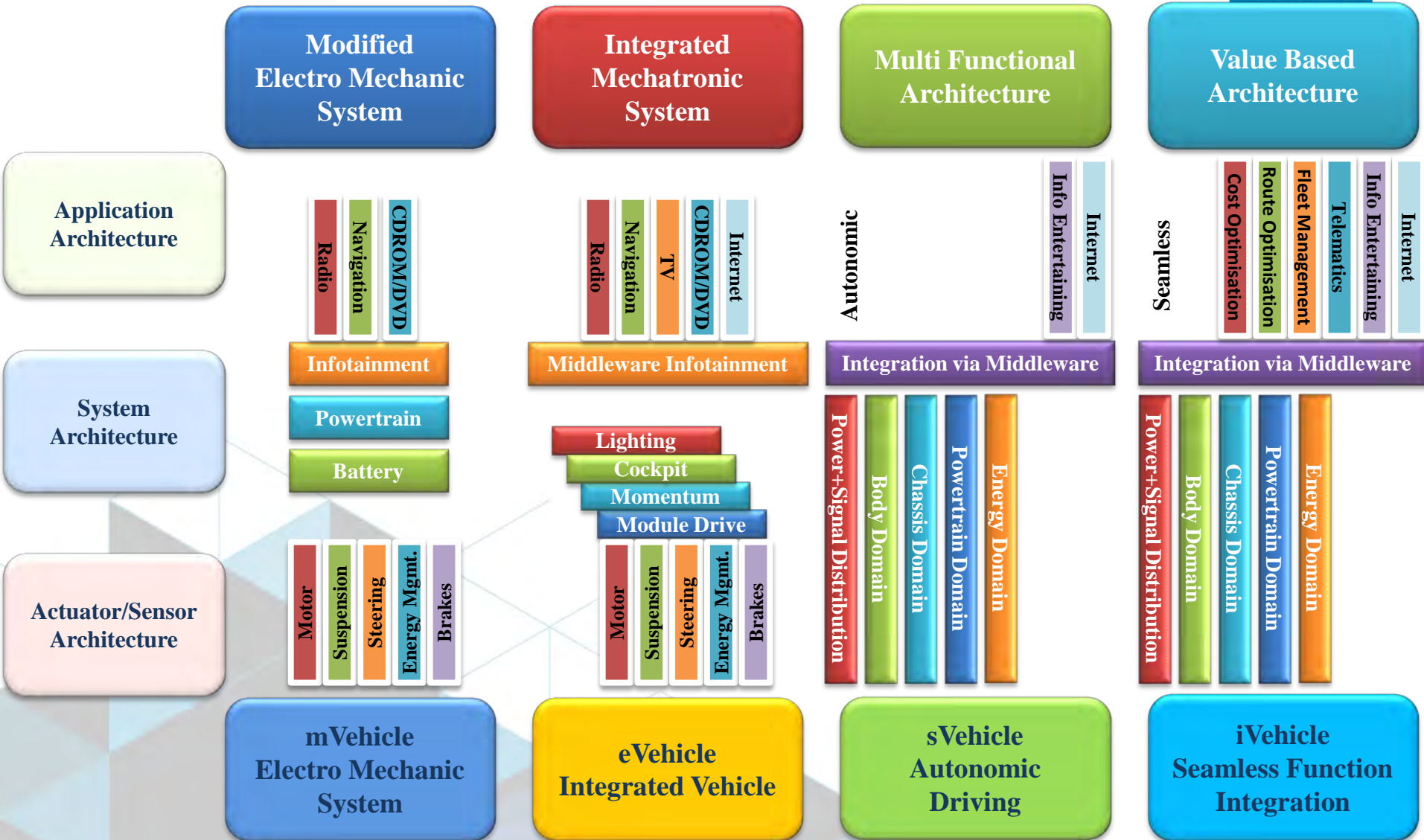
EV Architecture



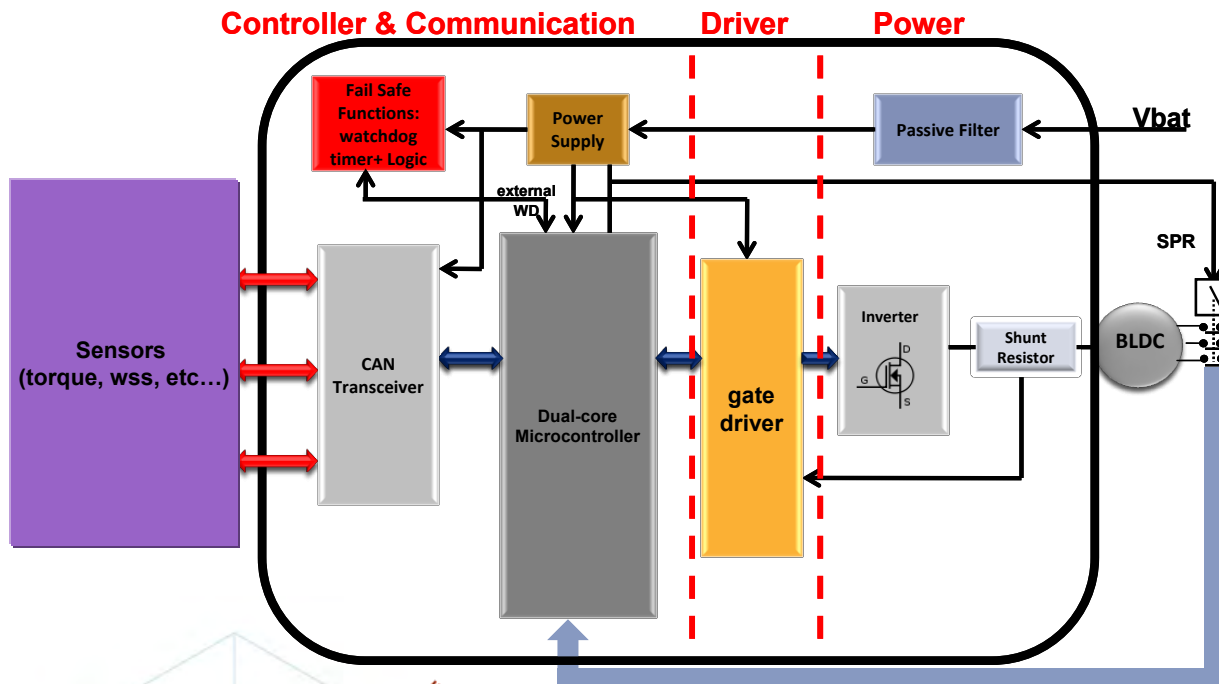
No of electric motors: 4
Main batteries, super capacitors & solar cells



EV Architecture



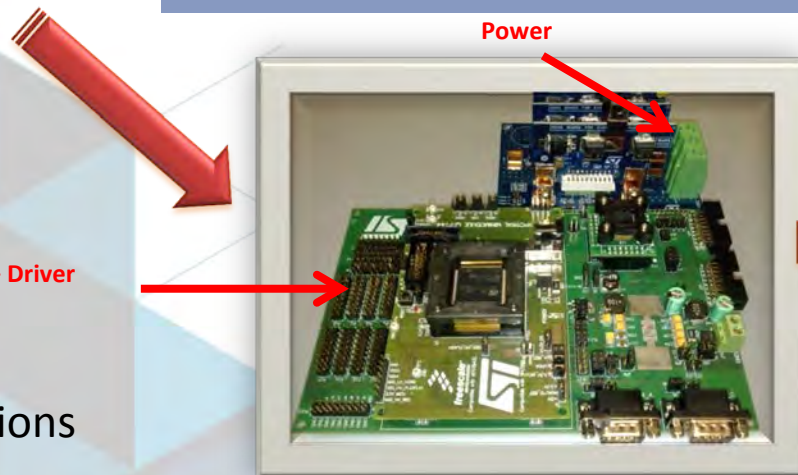
Microcontroller Platform



Dual-core microcontroller

Dual-core safety microcontroller platform based on the Power Architecture™ cores.

Innovative safety concept matches ISO26262 ASIL D;



Controller & Communication + Driver

ASIL C/D applications

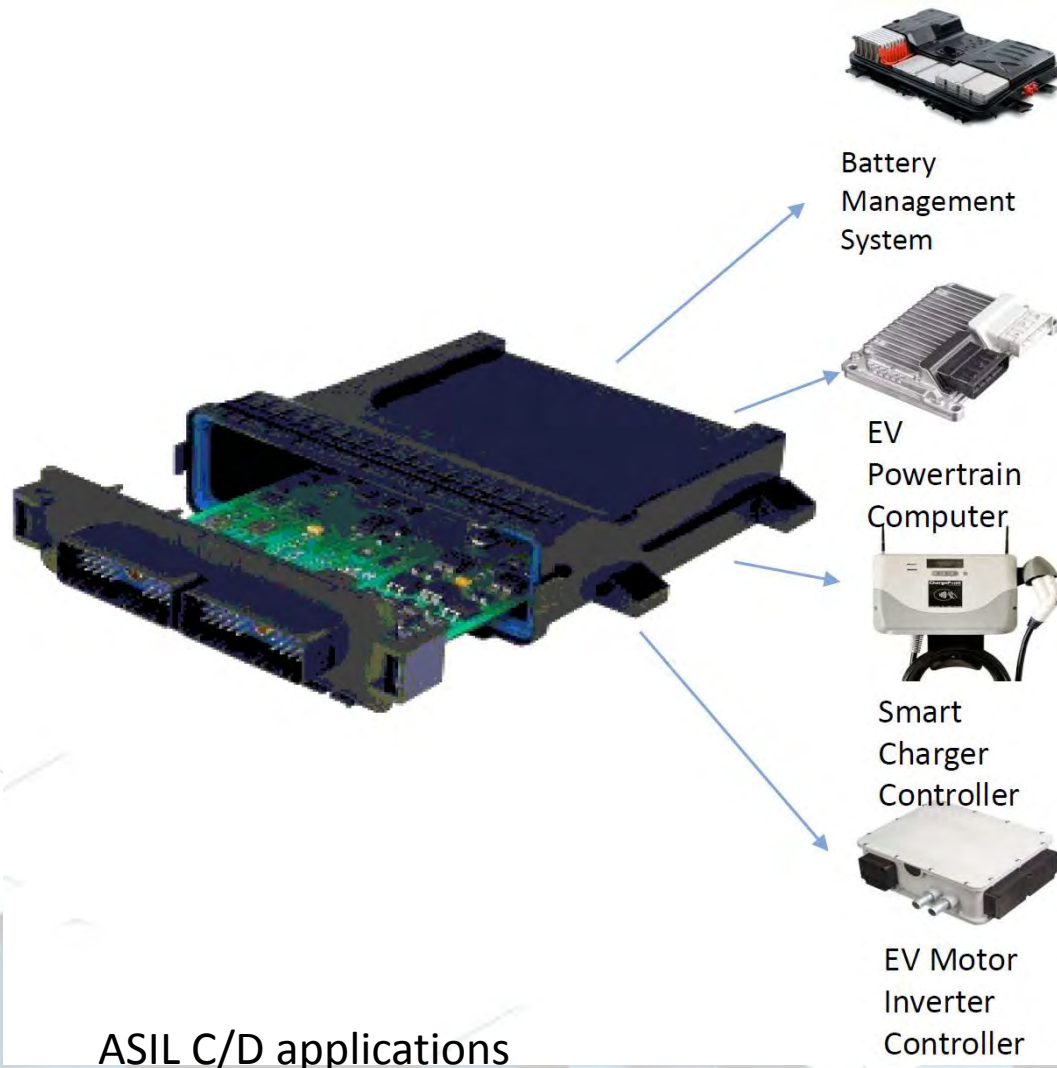


Source: STMicroelectronics

Microcontroller Platform



OIKOS Platform



- Silicon - AURIX
- Up to 3 independent 300MHz TriCore CPUs in one multicore silicon
- TriCore Microcontrollers
- Embedded HSM
- Optional integration of power electronics

ISO26262 ASILD

ASIL C/D applications

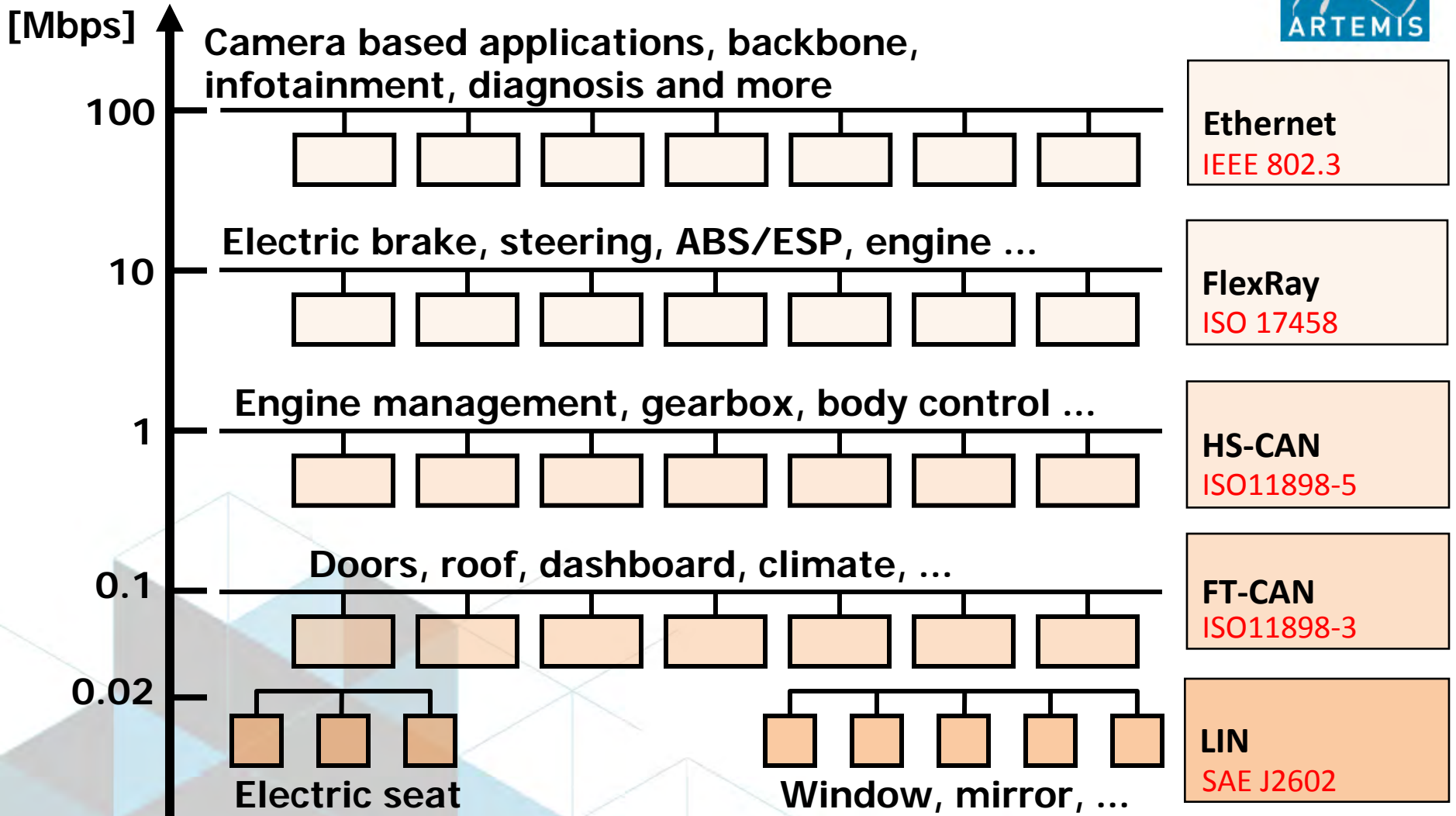
Source: Infineon

Networking Trends for E-Vehicles



- ▶ **New Boundaries** are set for domains
 - ▷ Safety and energy saving are main drivers for new E/E architectures
 - ▷ System partitioning based on used voltage levels (domain interfaces)
 - ▷ Chassis, body, powertrain become sub-categories
- ▶ **Longer Duty Time** (“EV never sleeps”)
 - ▷ Networking is (almost) never completely switched off
 - ▷ Alert for critical situations: system or HV battery failures
 - ▷ Anticipated role as “storage” medium in energy grid (while parking)
- ▶ Networking becomes Part of **Energy Management**
- ▶ **Higher Bandwidth** demands for communication

Networking



Source: NXP

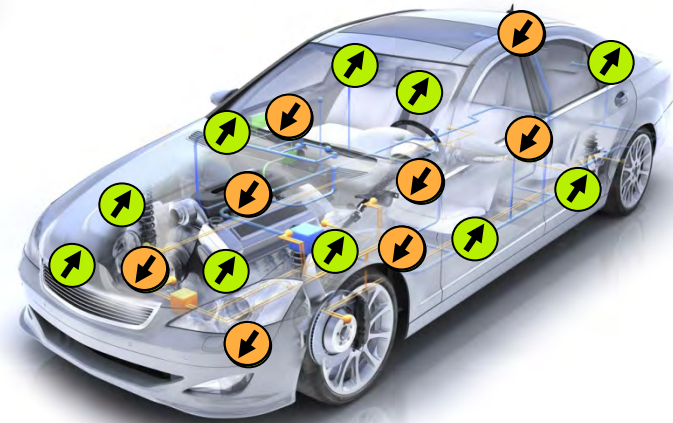
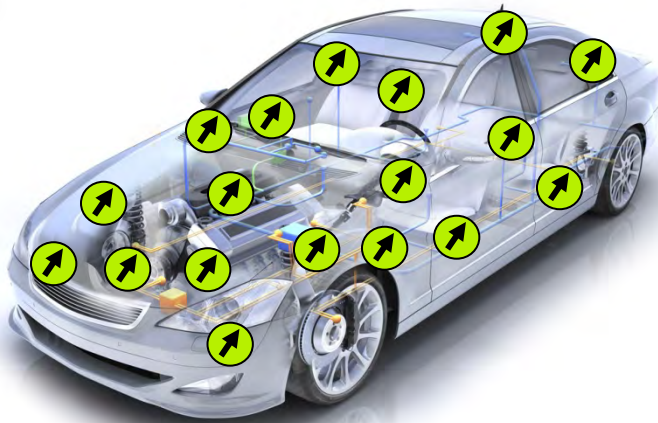
Partial Networking




- ▶ PN-enabled networks are capable of operating only those parts of a network that are functionally required at a given time

Without Partial Networking:

With Partial Networking:



 ECU on All ECUs active

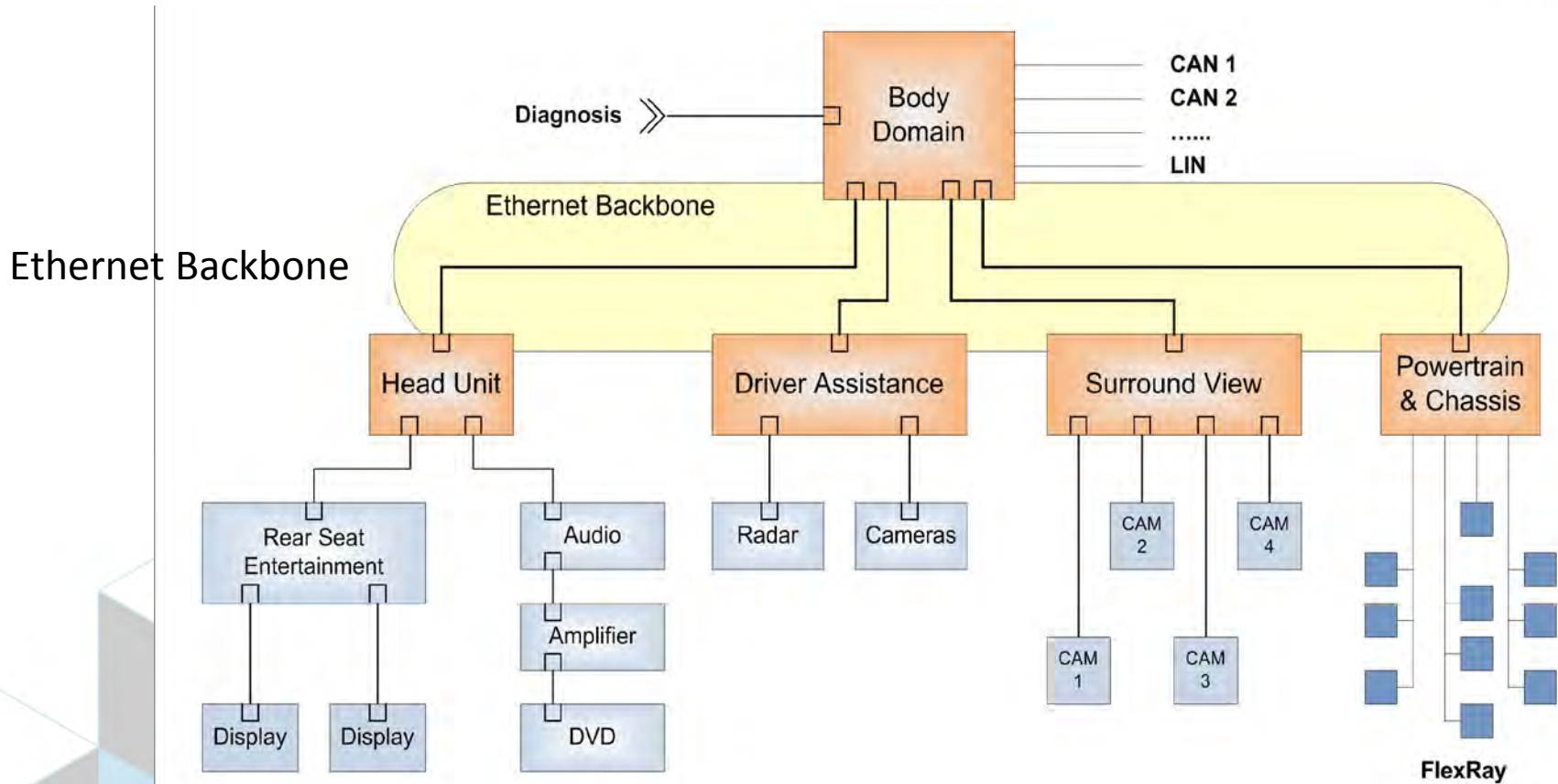
 ECU on **Only selected ECUs are active**
 ECU off

Enhancements addressed in POLLUX

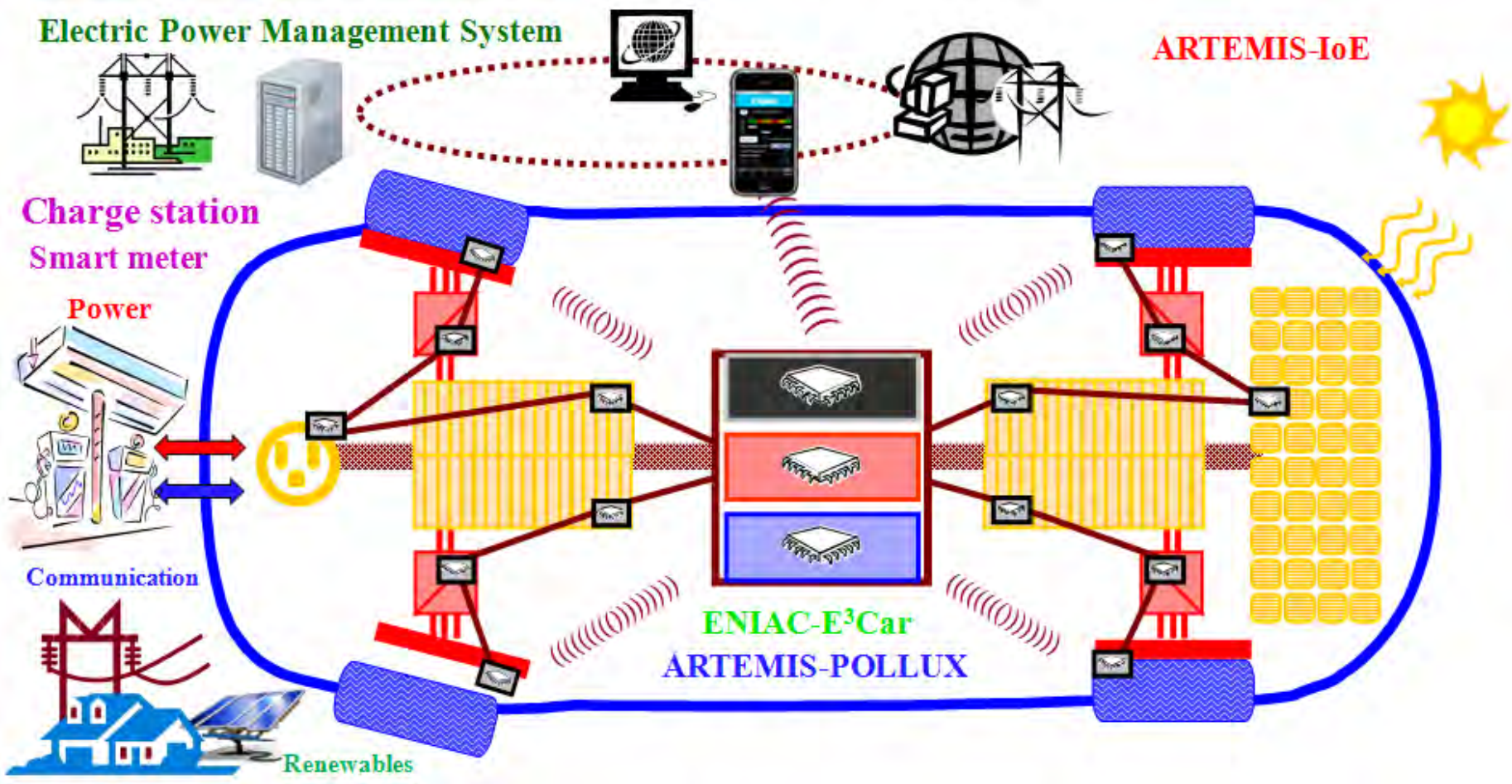


- ▶ CAN
 - ▷ More robustness - EMC Improvements
- ▶ FlexRay
 - ▷ More robustness for electrical vehicles
 - ▶ Active Star with Bit Reshaper
 - ▶ EMC Improvements
- ▶ Automotive Ethernet
 - ▷ Comparison of different standards

Future E/E Network Architecture



IoE - ENIAC E³Car - ARTEMIS POLLUX



“Creativity is the power to connect the seemingly unconnected.”

William Plomer (African born English Writer, 1903-1973)



Thank you for your attention!

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