A Systematic Investigation of Hardware and Software in Electric Vehicular Platform

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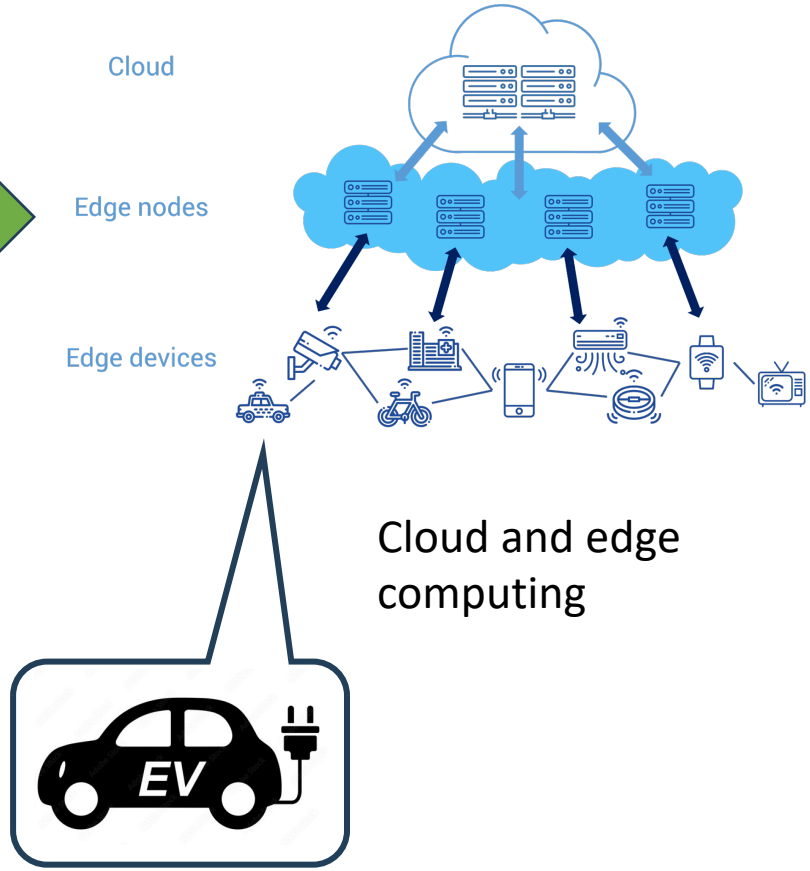
Outline

- Background, History, and Current Status
- EV Hardware
- EV Software
- Current Limitations and Research Directions
- Conclusion

Background

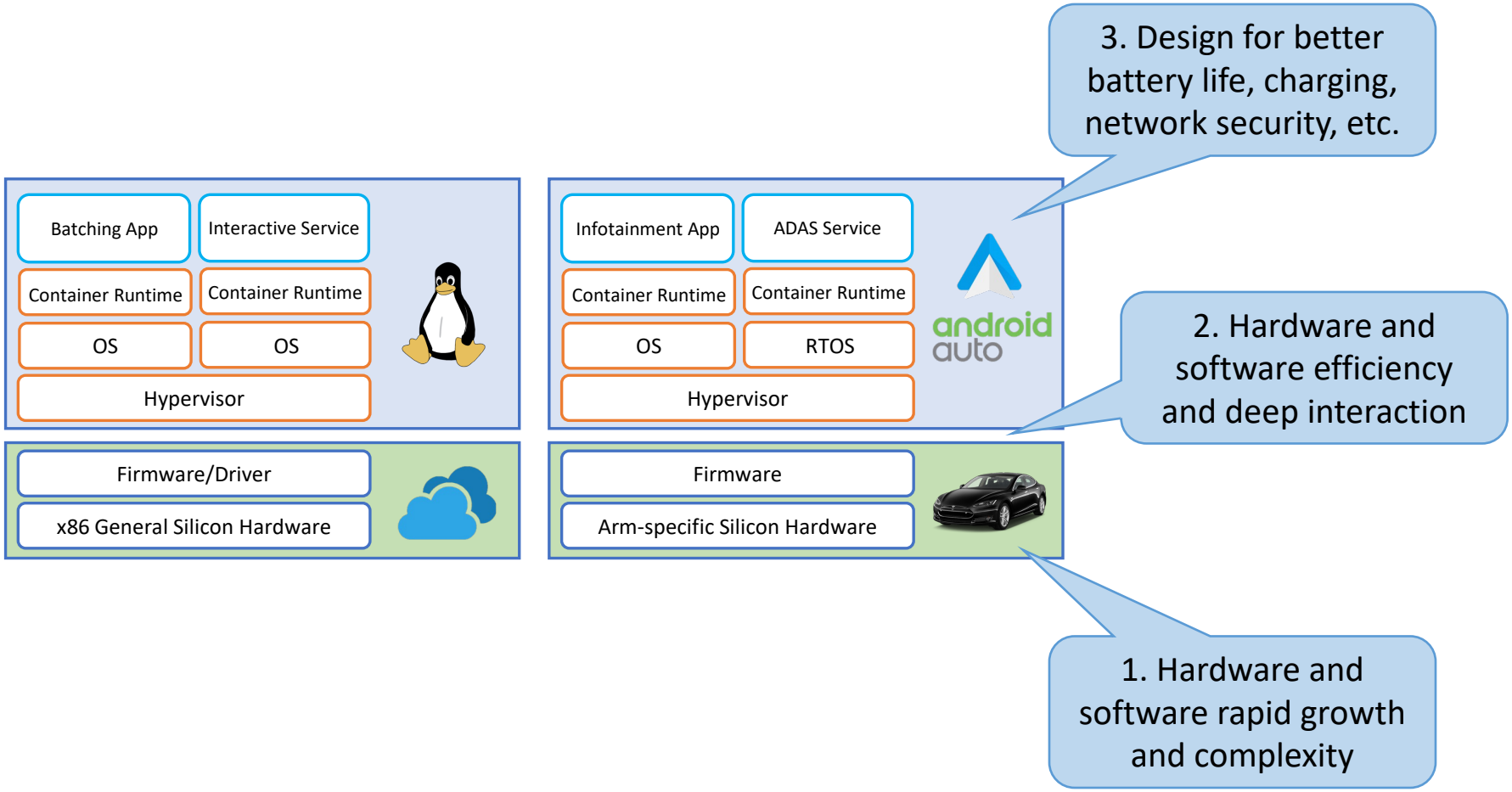
PC

Internet



Cloud and edge computing

Similarity and Unique Challenges



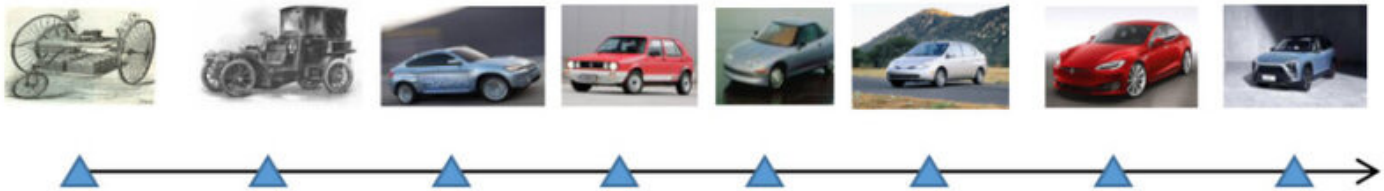
What this research is about?

We scrutinize the most advanced technologies currently in EVs and systematically examine EV systems.

We analyze constraints and obstacles in existing EV platforms and explore avenues for future development.

We aim to draw attention from scholars and shed light on further research on EV platforms and related technologies.

History of EV and Current Status



1873	1890	1972	1974	1990	1997	2008	2010
Britain	America	Germany	America	America	Japan	America	China
Electric tricycle	Electric four wheeler	BMW 1602e	Citi Car	GE EV1	Toyota Prius	Tesla Model S	Internet car

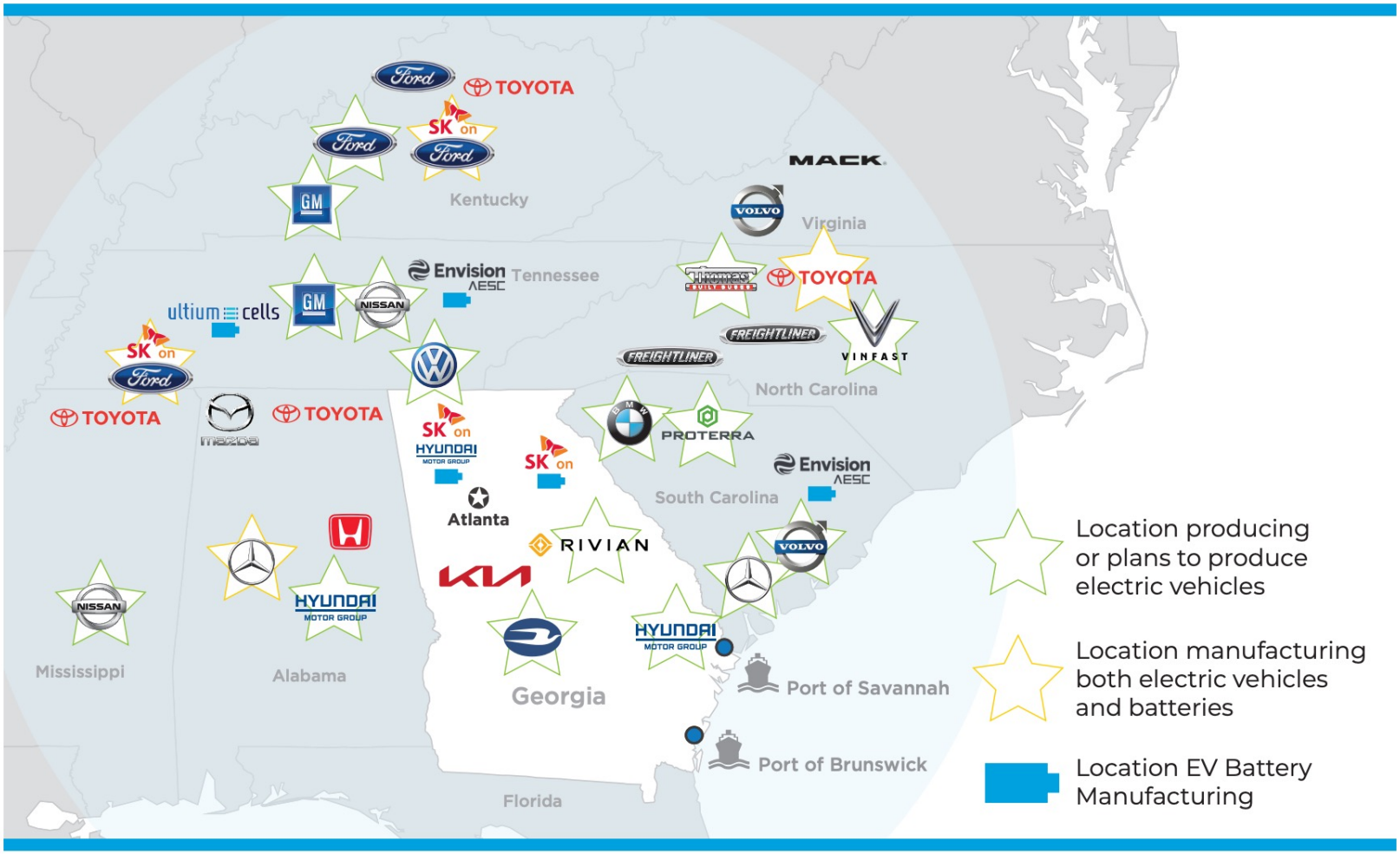
Pros

- Environment-friendly
- Save money on gas
- Less maintenance
- Enhanced performance

Cons

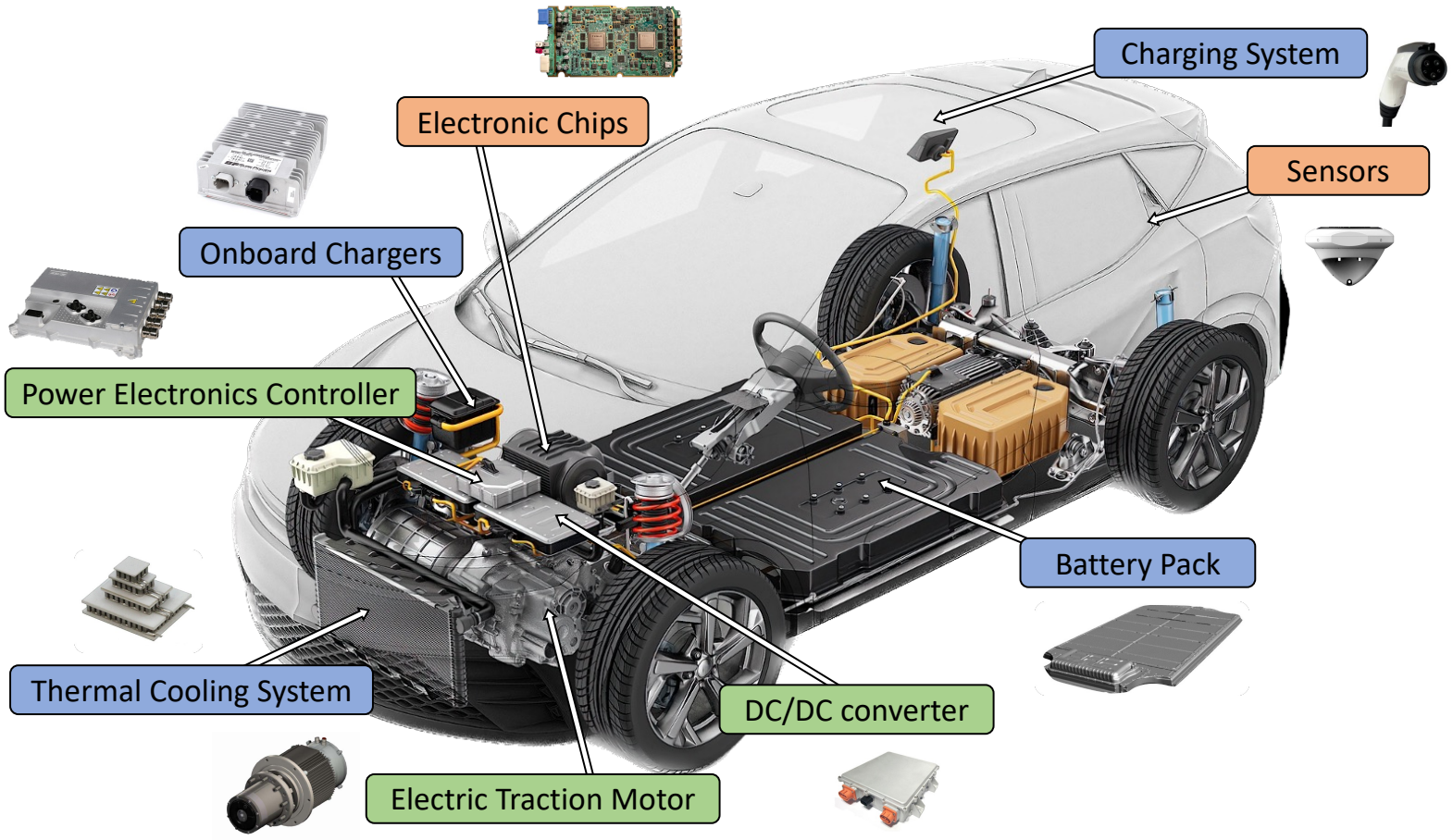
- High initial cost
- Finding a charging station
- Time to charge
- Problematic raw materials

History of EV and Current Status



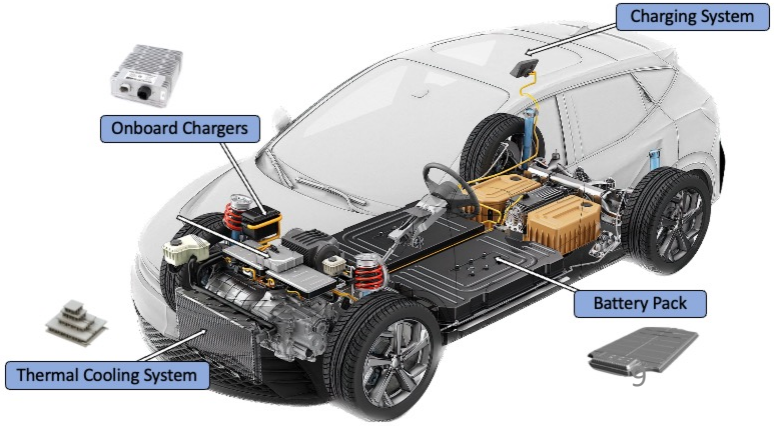
Source: Georgia Power Community and Economic Development

EV Hardware Overview



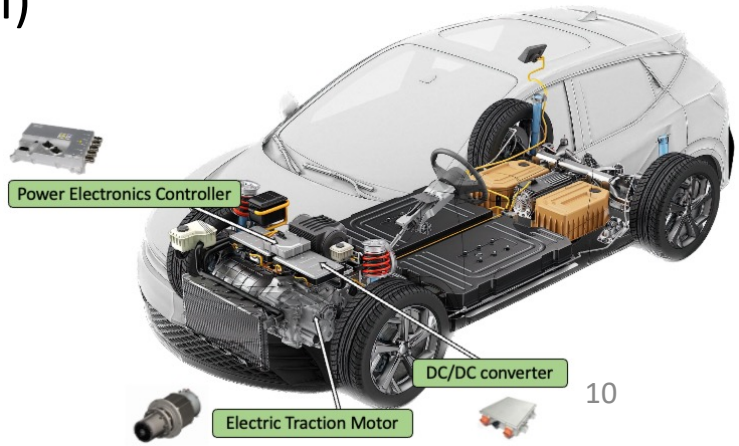
Energy Subsystem

- Charging System
  - ✓ Alternating current (AC) charging, direct current (DC) charging, AC-DC charging, and wireless charging.
- Battery Pack
  - ✓ Lead-acid battery, Ni-MH battery, Lithium iron phosphate battery, Ternary lithium battery, sodium-ion battery, etc.
- Onboard Charger
- Thermal Cooling



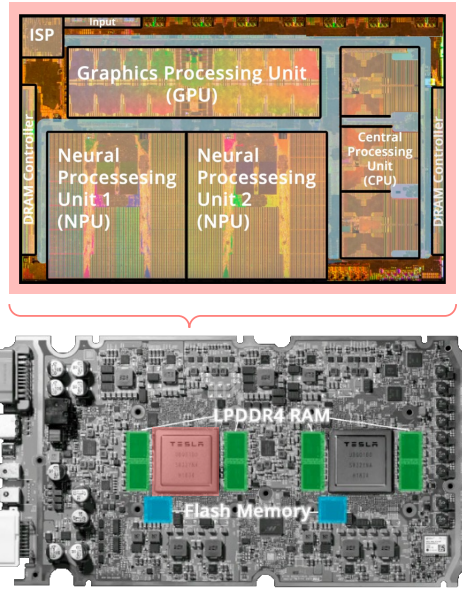
Control Subsystem

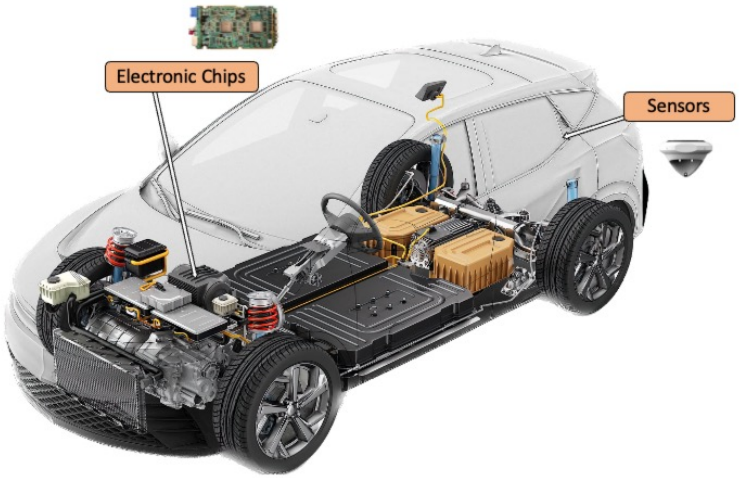
- Power Electronics Controller
  - ✓ w/ converter-inverter combinations to control energy flow to and from the battery
- Electric Traction Motor
  - ✓ DC motors, permanent brushless DC motors (BLDC), induction motors, permanent magnet synchronous motors (PMSM), and switched reluctance motors (SM)
- DC/DC Converter



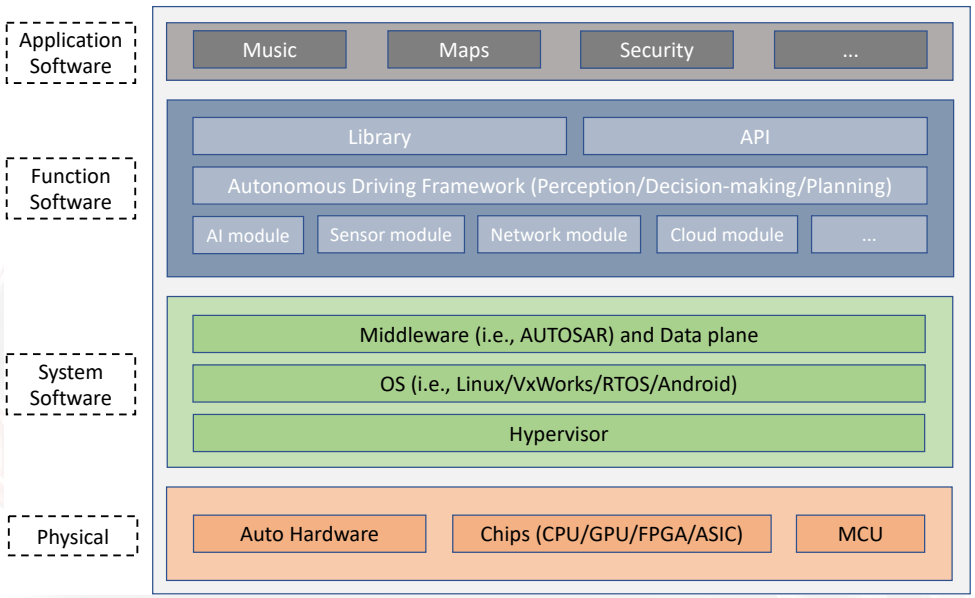
Automotive Semiconductors & Sensors

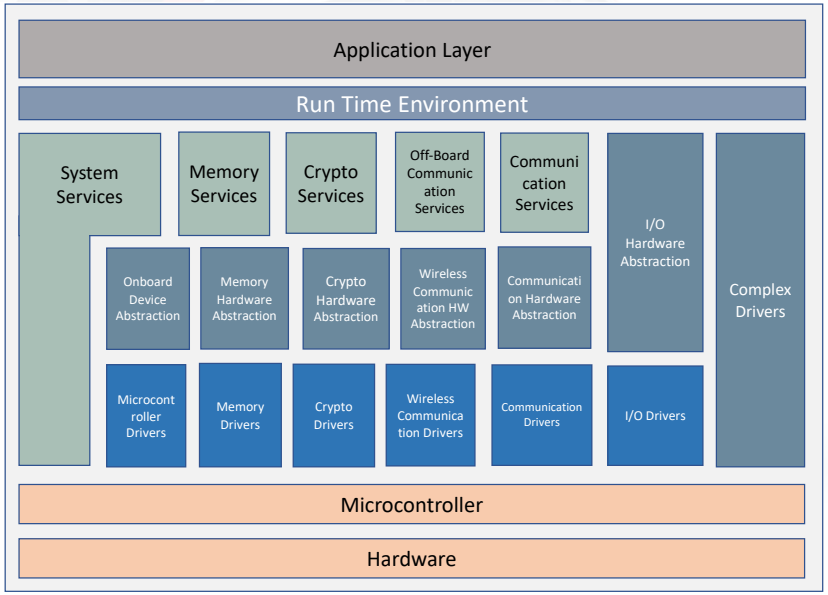
- Each vehicle contains an average of 1,400 semiconductors
  - ✓ System-on-chip (SoC) chips, power semiconductors, sensor chips, power management chips, etc.
- More sensors in EVs
  - ✓ Environmental perception senso body perception sensors, interio sensors, etc.





EV Software Overview





Automotive Open System Architecture

EV Applications


PlugShare


ChargeHub


Chargemap


Tesla


JustPark Parking


EV8 Switch


Electromaps


ChargePoint


EVgo


EVHotels


WattsUp


EV Connect


Steer EV


Octopus Electroverse


A Better Routeplanner (A...


Chargeway


Google Maps

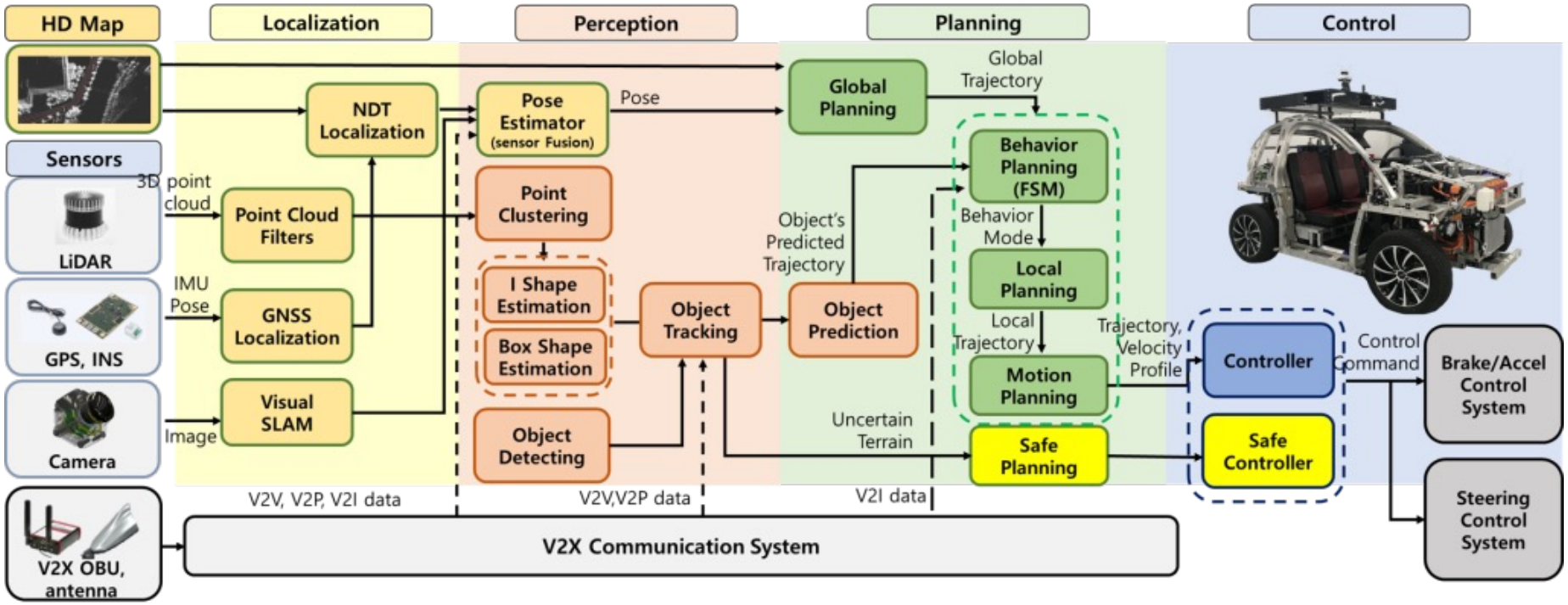

Electrify America


Bonnet


Waze


RingGo Parking app

Autonomous Driving



Current EV Limitations and Research Directions

- Energy & Power Supply
- Price & Cost
- Safety & Security
- G2V & V2G
- Intelligence & Autonomous Driving

Conclusions

- **Background & Challenges**
  - ✓ EVs have become the next-generation computing platform and innovation stage, with unique advantages and challenges.
- **This Research**
  - ✓ A study analyzing the status of EV technology, hardware and software systems, and future trends.
- **Contribution**
  - ✓ Guide more scholars to pay attention to the development of EV platforms
  - ✓ Help explore to help build the next generation of smart, efficient, and safe EV platforms and infrastructure.

Thank you !

Questions?