



VISION-BASED ADAS: SEEING THE WAY FORWARD

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- One Slide Strategy Analytics Overview
- Why is ADAS Interesting?
- What is the Market Growth?
 - Regions? Applications? Sectors? Sensors?
- Vision-Based ADAS
 - Opportunities & Challenges
 - Typical Value Chain
 - Architecture Trends
- So What About Self-Driving Cars?
- Conclusions
- Q&A

INSIGHTS, INFORMATION, & ADVICE



Market Intelligence on Buyer Behaviors, Consumer Attitudes, Brand Preferences, and Emerging Behaviors

Insights, Information, Forecasts, and Consulting on Companies, Brands, Products, and Technologies across industries including Automotive, Wireless and the Digital Home



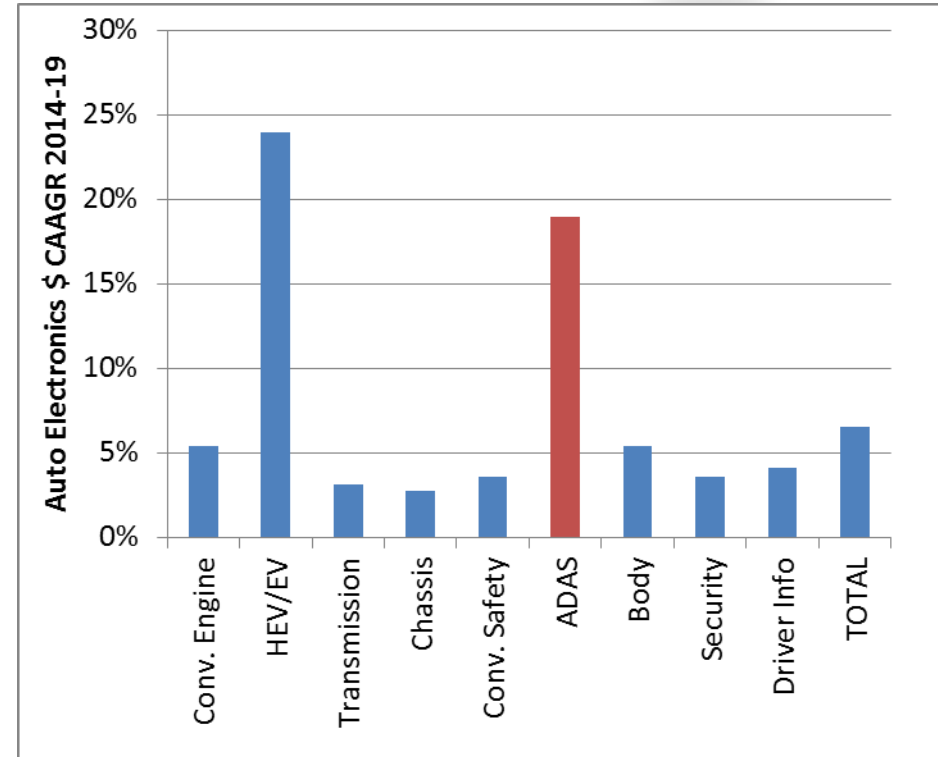
Design Guidance and Competitive Intelligence on User Experiences and Opportunities for Innovation

Intelligence on Consumer Activities, Behavioral Patterns, and Usage Profiles through Big Data Analytics

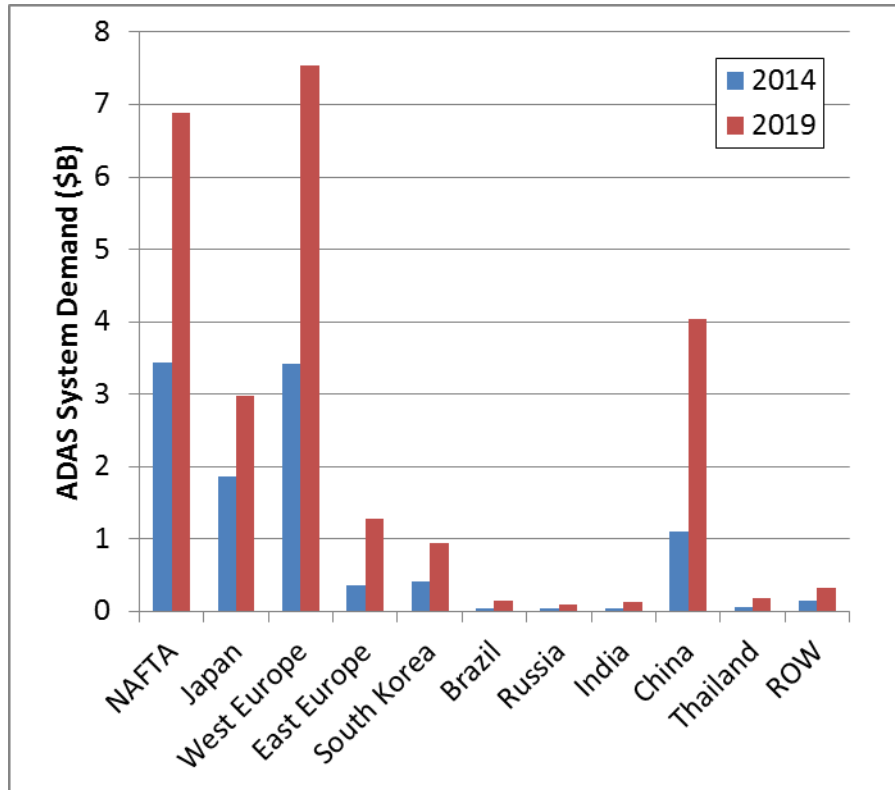


WHY IS ADAS INTERESTING ?

- One of the fastest-growing application areas for automotive electronics
- Far more certainty and upside potential than for HEV/EV electronics
- Driven by a combination of governmental / legislative push and increasing consumer pull
- Driving changes in industry value chains & ecosystems



WHERE IS ADAS GROWING FASTEST ?

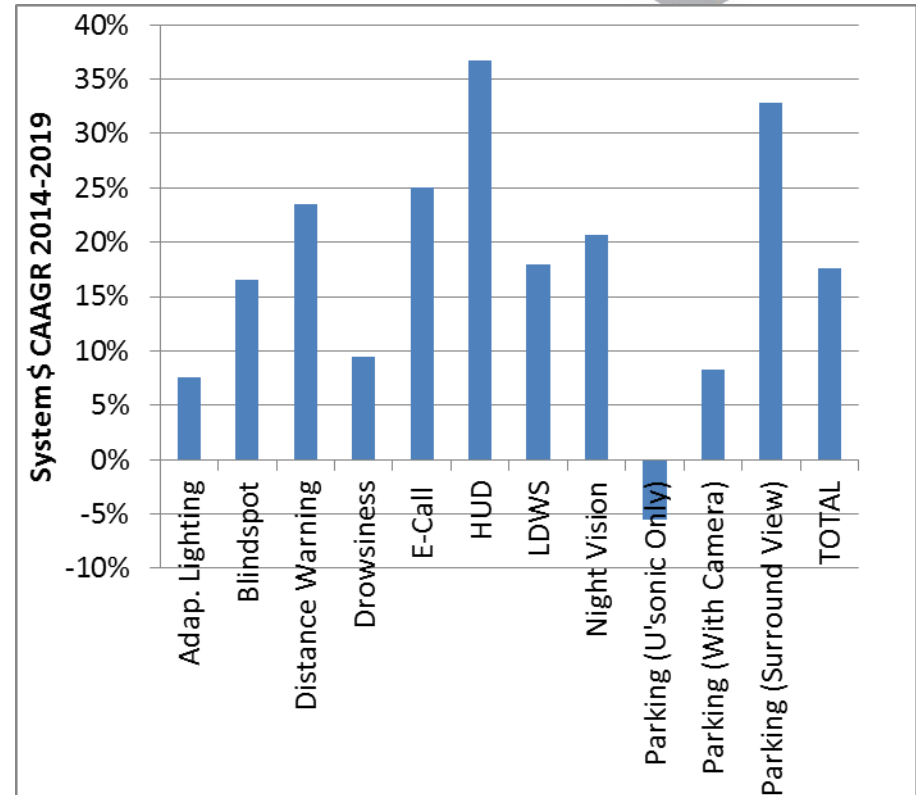


- Demand largest from light vehicles manufactured in Western Europe & NAFTA
- Fastest growth rates for vehicles produced in Eastern Europe, Brazil, India & China
- ADAS \$-per-vehicle highest for vehicles produced in Western Europe

WHICH APPLICATIONS DRIVE GROWTH?

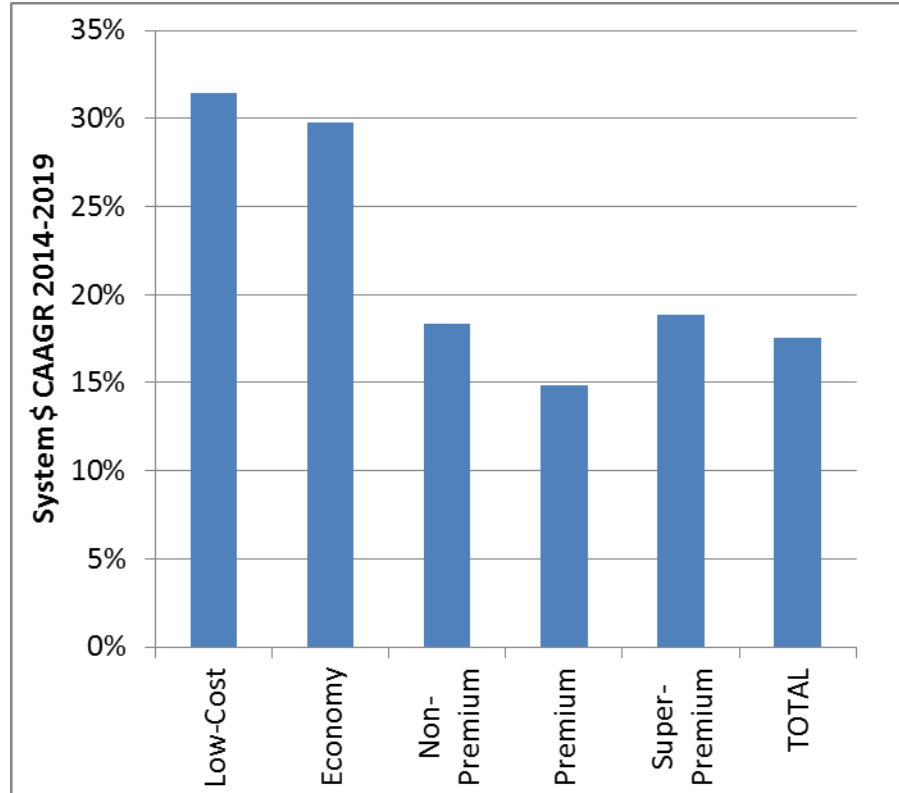


- Fastest \$ growth is forecast to be in Head-Up-Display and Surround View Systems
- Growth in almost all systems except for ultrasonic-only park assist
- Most systems seeing \$ market growth at 15%/yr or higher





NOW IN MAINSTREAM VEHICLES

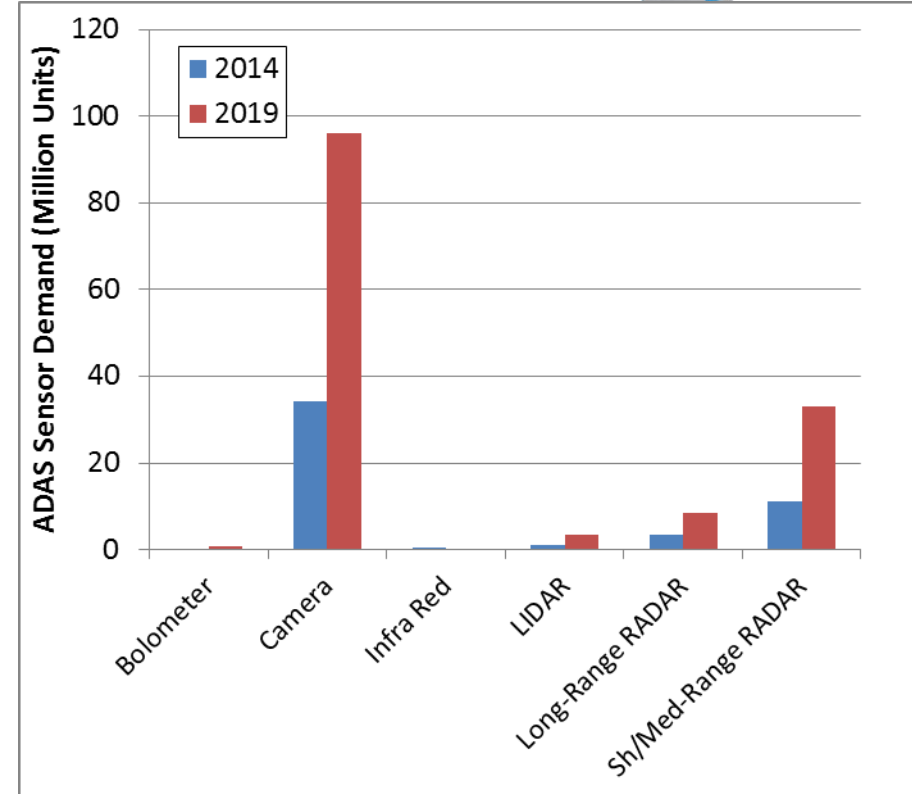


- Slowest ADAS growth now in Premium vehicles (e.g. BMW, Mercedes, Audi, Lexus)
- Fastest is in low-cost & economy vehicles – but still only 4% of ADAS \$ demand in 2019 (mainly park-assist)
- Non-premium (e.g. Ford, GM) now growing faster than premium and will be 63% of market in 2019



IMAGE SENSORS ARE VITAL

- Volume demand for camera sensors to outstrip all other sensor types (excluding ultrasonic)
- Over one camera-per-vehicle forecast in 2021
- Strong regional variations
 - Most cameras/vehicle in NAFTA, followed by Japan & Europe
 - Over 50% of Chinese-produced light vehicles expected to have a cameras in 2021





WHY VISION-BASED ADAS ?

- Camera sensors are low-cost
- A number of applications can ONLY be implemented with cameras
- Few, if any, applications cannot be implemented with a camera, even if it is not (yet?) the ideal solution
- Camera is thus the ideal “base sensor” around which to build an ADAS strategy



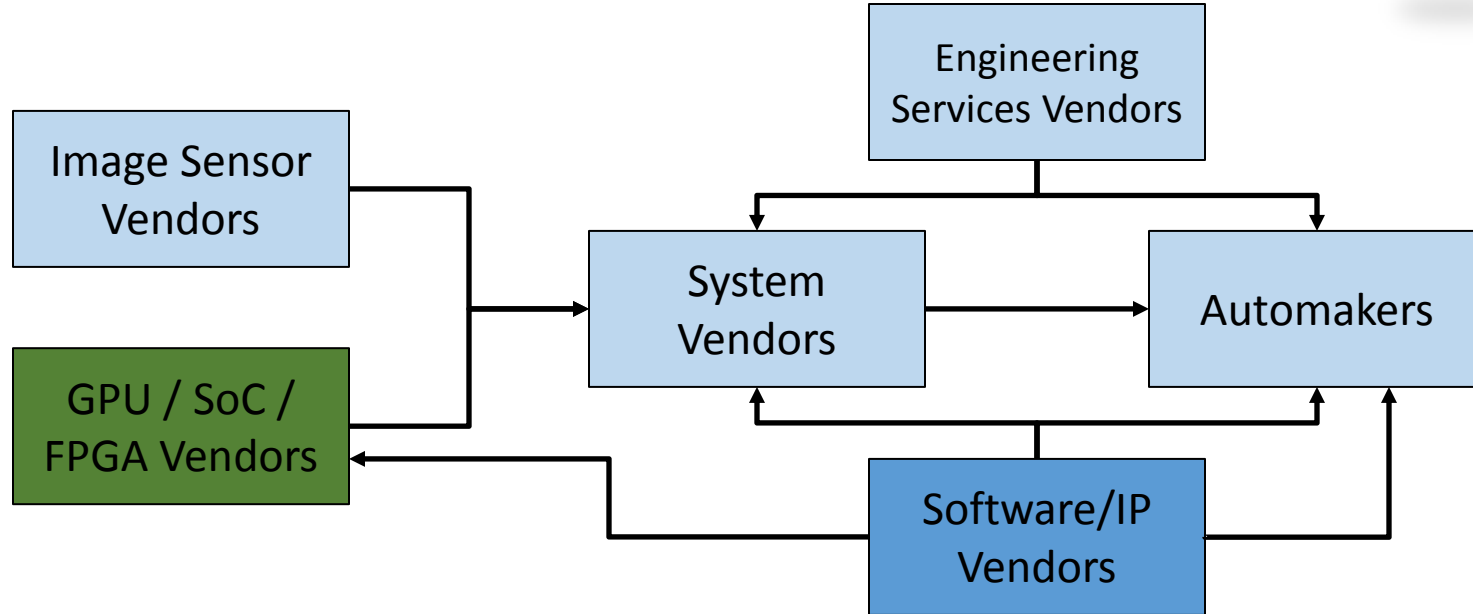
Source: TRW



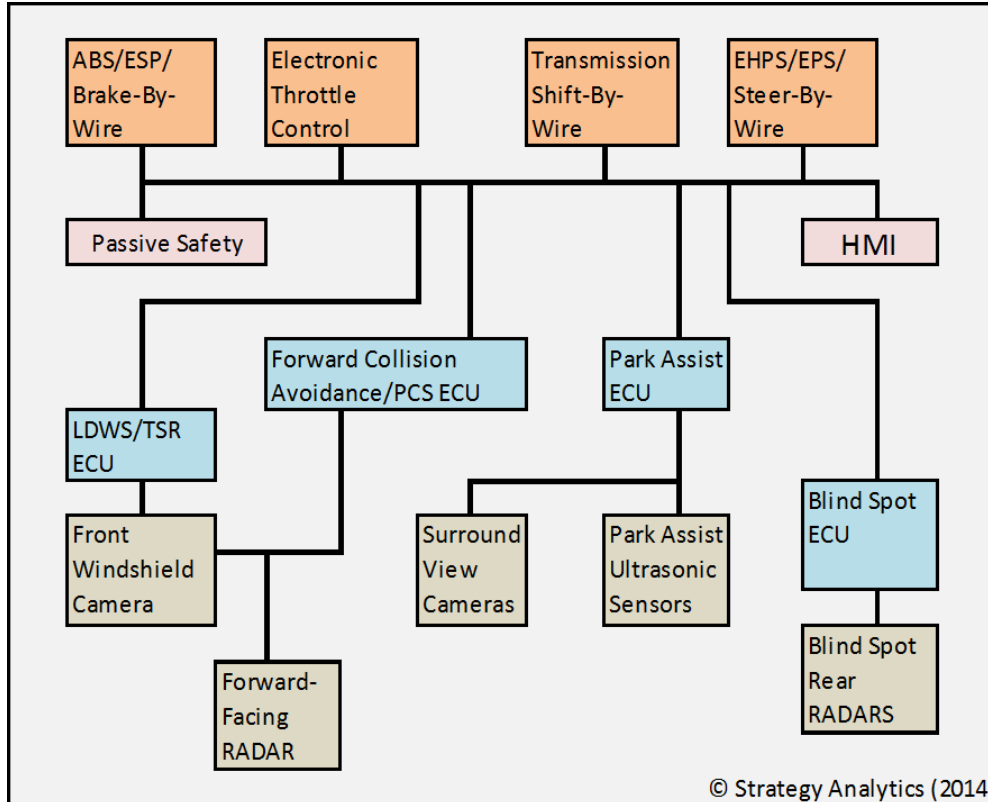
Source: Harman

- RADAR prices are falling fast
 - But a RADAR is seldom a replacement for a camera
- High-speed data links for digital camera data can be pricey
 - Move to megapixel means SERDES/LVDS or Ethernet approaches ideally needed
 - Prices are coming down
- New entrants at multiple-levels in value chain
 - OEM attitudes to non-traditional safety suppliers are changing

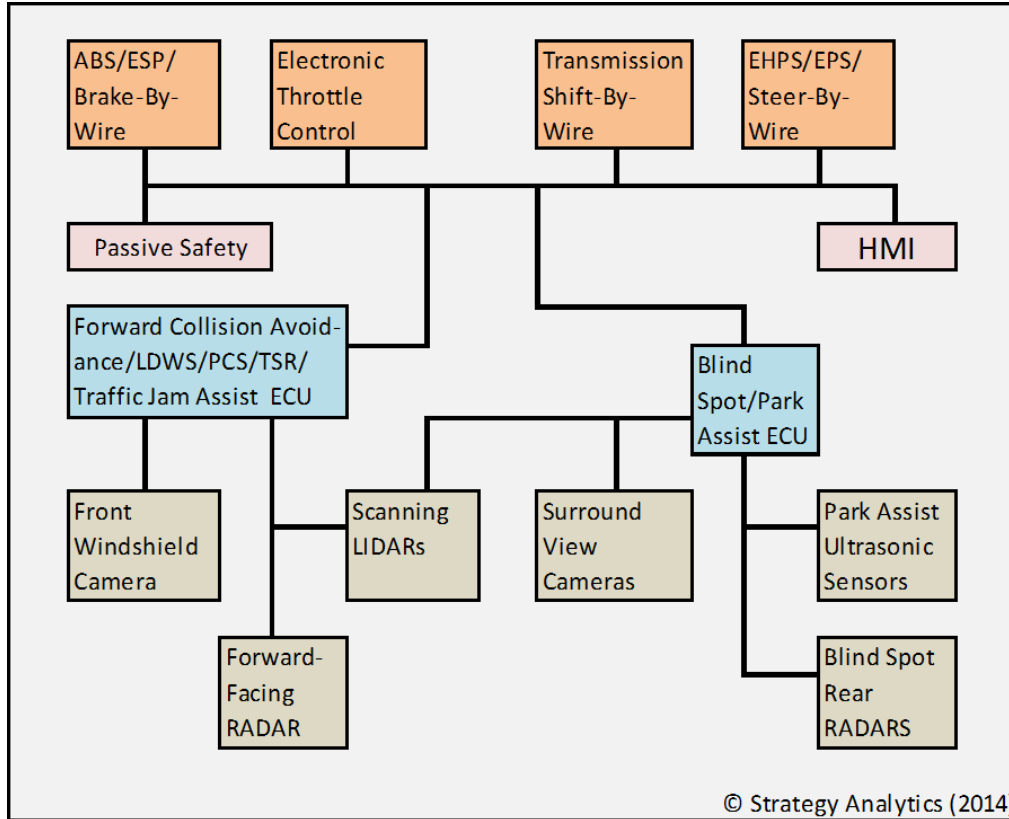
TYPICAL CAMERA ADAS VALUE-CHAIN



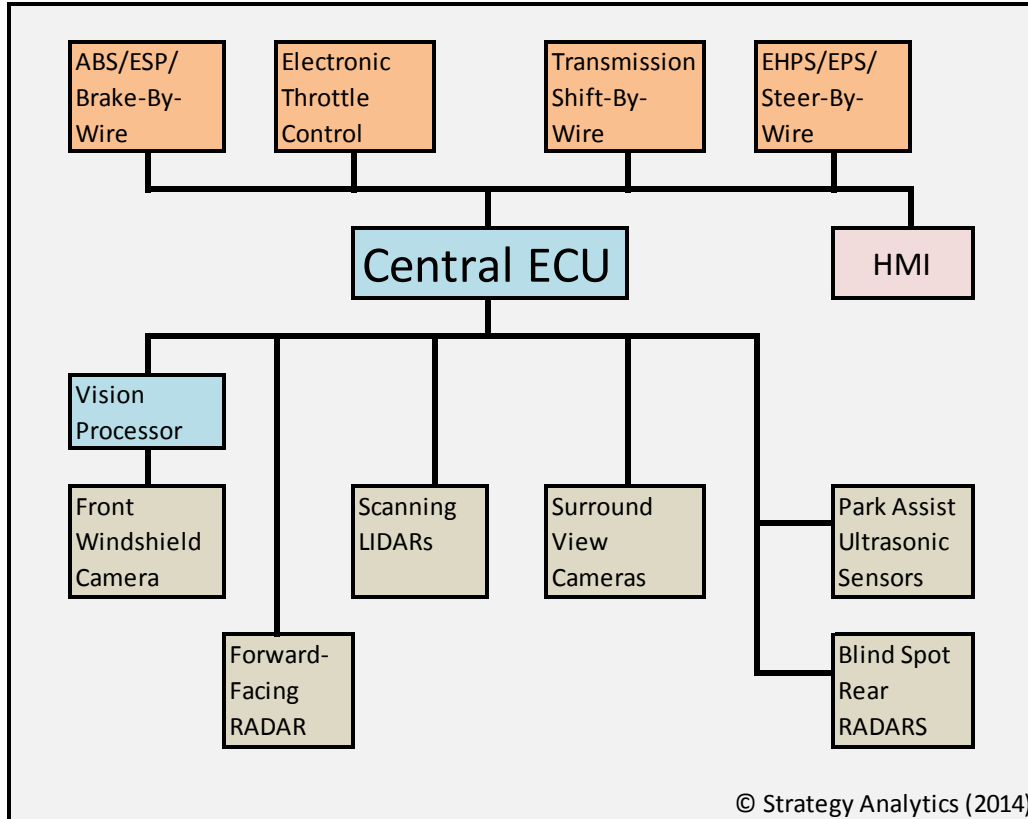
- Many new players in both silicon and software/IP are challenging the traditional automotive value chain



- Current architectures highly decentralized
- General paradigm is 1 function = 1 box
- Makes sense when features are optional and fitment rate is low
- Only high-level data communicated from box-to-box



- Emerging architectures see emergence of “ADAS domain controllers”
- More sensor fusion and integration
- Still typically only high-level data communicated from box-to-box



© Strategy Analytics (2014)

- Many functions combined in powerful central ECU
- Separate vision processor may remain?
- Only makes sense when features are standard and fitment rate is high
- High-speed communications typically required

SO WHAT ABOUT SELF-DRIVING CARS?



- With the truly autonomous vehicle **everything changes**
 - Powertrain & chassis becomes far less relevant
 - Comfort/convenience and infotainment (but not necessarily car-mounted infotainment) features become far more important
 - ...and so much more...





CONCLUSIONS

- ADAS is one of the fastest growing application areas for auto electronics
- It is growing in all regions, lead by Europe, and now penetrating strongly into mass-market vehicles
- Vision-based technologies are at the heart of ADAS
 - Low-end vehicles most likely to feature single forward-looking camera as the key ADAS sensor
 - Fused forward RADAR/camera likely platform of choice for mid-range & above
- Changes are challenging the traditional automotive ecosystem, with new players seeking to break in from software through semiconductors up to the system level
- Architectures will slowly become more centralized – but this only makes sense when a high-level of functionality becomes standard
- The truly self-driving car changes EVERYTHING. It is no longer a car!



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