



THE CAR - A COMPUTER ON WHEELS

What Does it Mean for
the Automotive Industry?

Ödgård Andersson,
Vice President Software and Electronics, Volvo Cars



SHIFT HAPPENS



Autonomous



Connected

**Sharing/
subscribing**

Software & AI



Electric cars

ELECTRIFICATION

- Happening now!
- Huge OEM investments
- New entrants - lower barriers
- Greener than fossil and cheaper to charge
 - secure green production of batteries and electricity
- Charging infrastructure impacts penetration
- 10-100x fewer moving parts – “no maintenance”
- Consumer pull & Legislation push



COST OF BATTERIES?

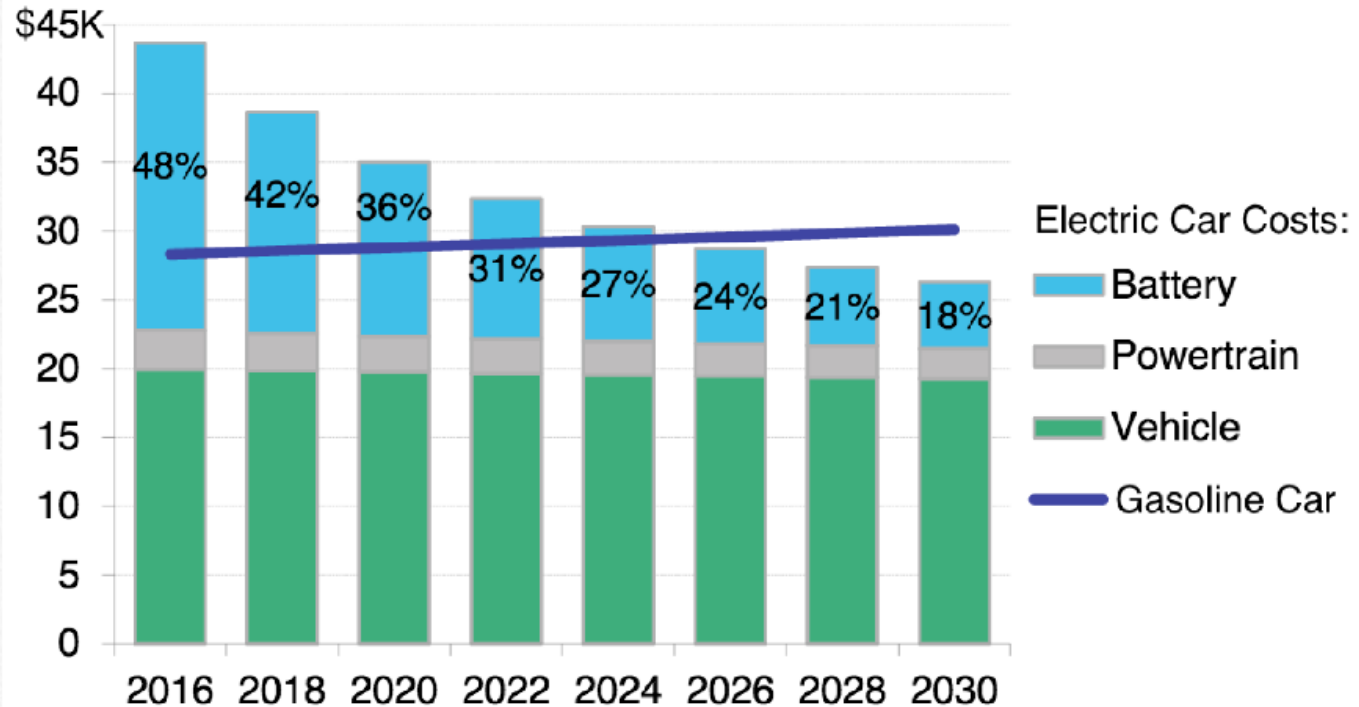
The shrinking battery costs lead Bloomberg to forecast that [electric cars will undercut gasoline cars on price by the mid](#)

Contradicting Trends:

- Rapid battery technology development
- >driving cost down
- Rapid increase in demand & limited availability of raw materials
-> driving cost up

Electric Cars Will Win on Price

Falling battery prices undercut gasoline cars by mid-2020s



AUTONOMOUS DRIVE



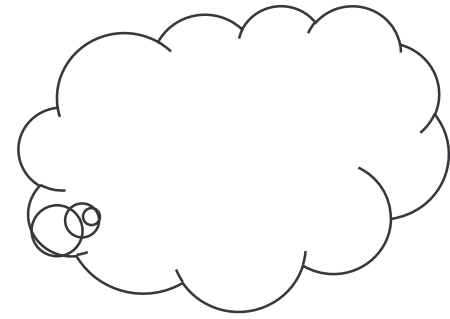
AUTONOMOUS DRIVE

- Approaching from 2 starting points
 - Evolution of ADAS systems from L2->3/4/5
 - Robot taxi aiming directly for L4/5
- New entrants: Waymo, Uber, Lyft, Baidu, Didi, Nuro, ...
- New partnerships
- Deep Learning & AI – massive computer power
- New sensors and sensor fusion – rapid development
- Cloud solutions, V2V+V2cloud, positioning - more computer power needed in car and/or in cloud
- Required redundancy and new levels of high availability



ALL CONNECTED

OTA



SHARING

- General trend from other industries
- Several parallel business models:
 - Subscribe to a car
 - Share your own car with others (like Air BnB)
 - Use on demand (Mobility aaS)
- Variable size per need
- Who owns the end user relationship?
 - OEM directly to end user - digital
 - New players – Turo, Waymo, ...
- Fleet management complex
- Autonomous drive and electrification as catalysts
- Uptime is king! - Design for low failure rate

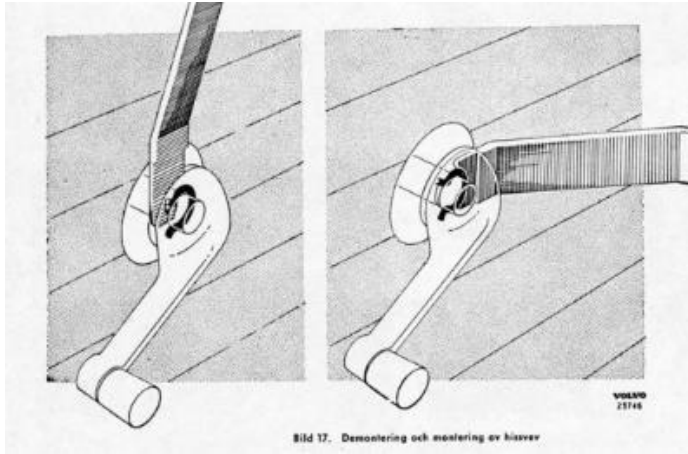


MORE SW - IN CAR AND IN CLOUD

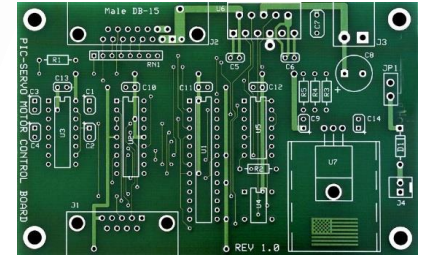


FROM MECHANICS - TO ELECTRONICS + SW

CURRENT STATE



0/1

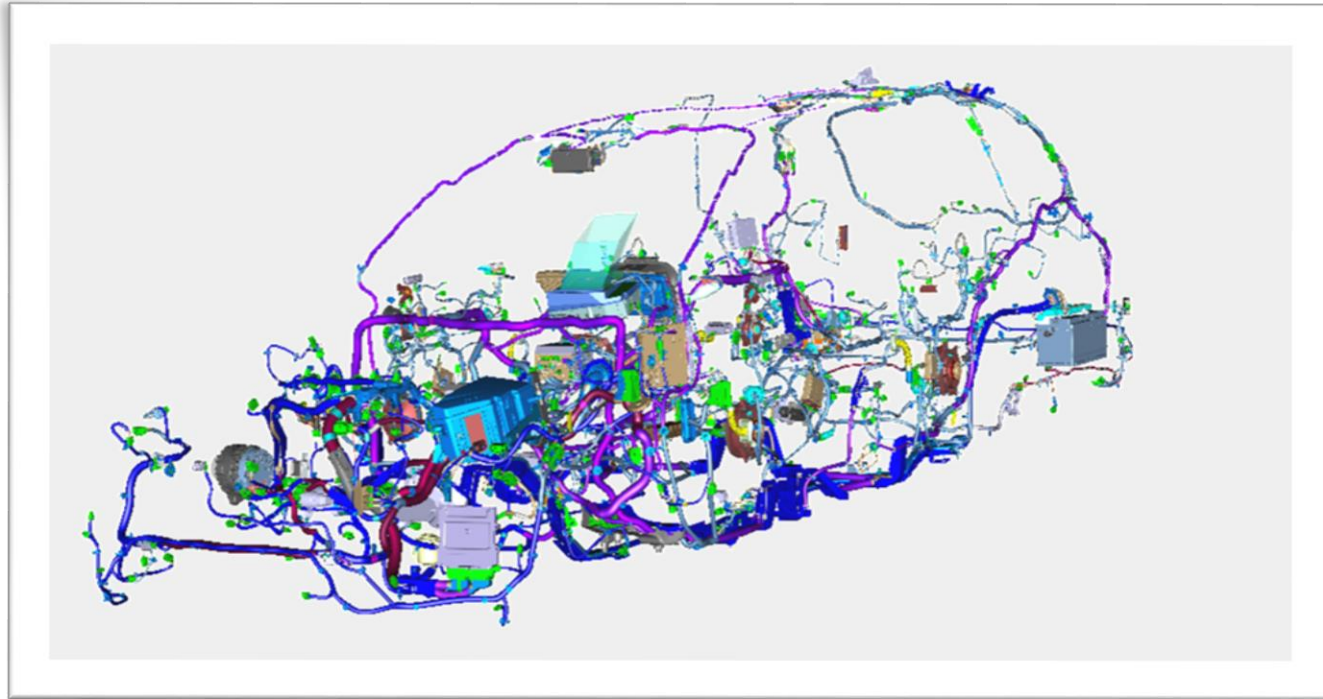


Electronics are sourced with their SW from Tier 1
Unintended side effect - all the SW is changes
when HW supplier changes

FROM MECHANICS -> ELECTRONICS + SW

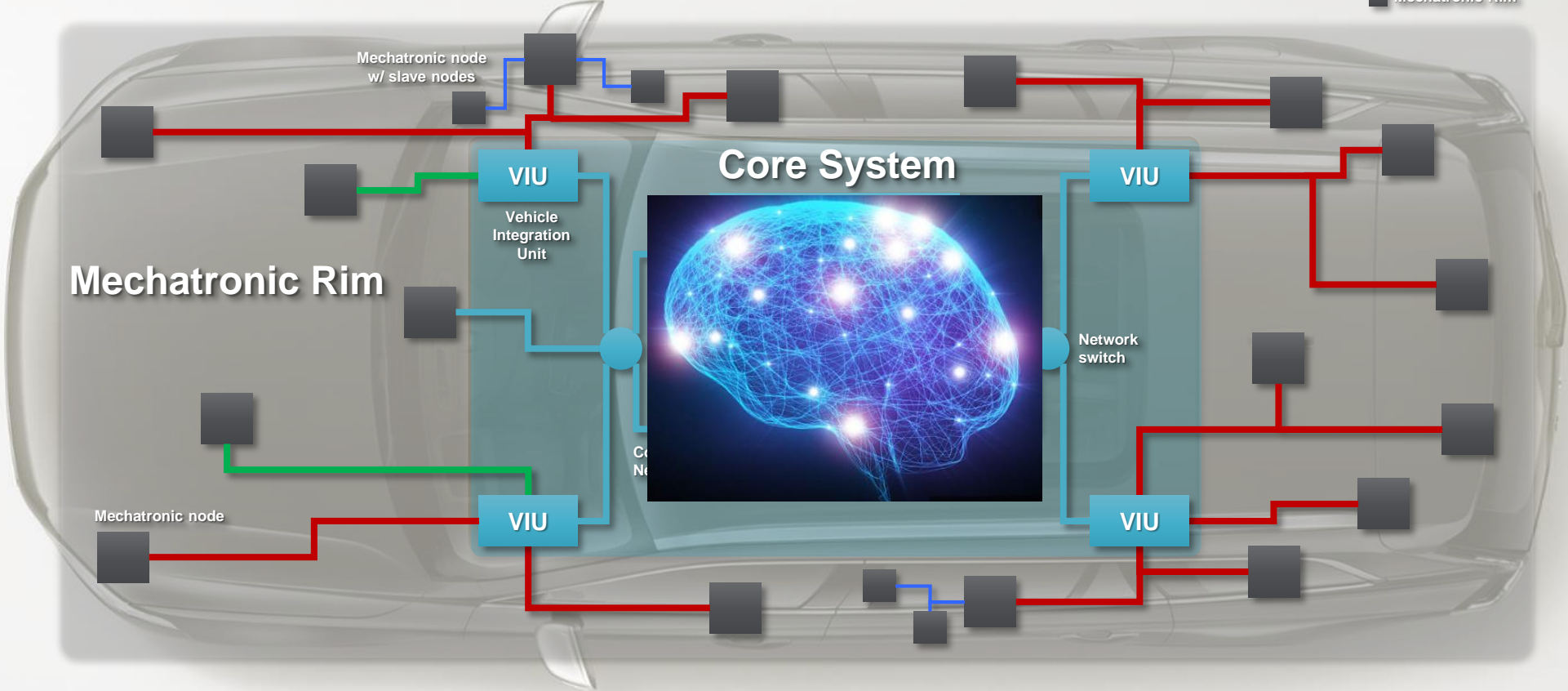
CURRENT STATE - COMPLEX ARCHITECTURE

HW&SW dependencies – long change loops



COMPUTER ON WHEELS -CENTRAL BRAIN

■ Core System
■ Mechatronic Rim



SW ARCHITECTURAL EVOLUTION

- Distributed Logic -> Central Brain Computer
- OEM control SW and/or SW will be open sourced
- Tier 1 future role?
- Prepared for growth vs optimized for cost
- High availability and redundancy
- Deep Learning and AI
- Decoupling SW from HW – one track SW
 - Enabling agile SW development
- Continuous Integration as base



FLEXIBILITY / AGILITY – PLANNING FOR CHANGE

- X industry customer expectations
- Large technology steps
- Impossible to predict timing of change
- On board/off board
- Control of high value SW

Flexibility is key!



PARTNER FOR SPEED & GREATNESS



<https://youtu.be/ogfYd705cRs?t=2160>

https://www.youtube.com/watch?v=kKQ5T-OqU_8

<https://www.youtube.com/watch?v=38aeJrs-mhg>



SHIFT HAPPENS



Sharing/
Subscribing

Software & AI



Autonomous



Connected

Q & A





THANK YOU FOR YOUR ATTENTION

