Software Complexity!

It is not a gimmick, it is the threat to the world

H.S. Sarjoughian

CSE 460: Software Analysis and Design

School of Computing, Informatics and Decision Systems Engineering
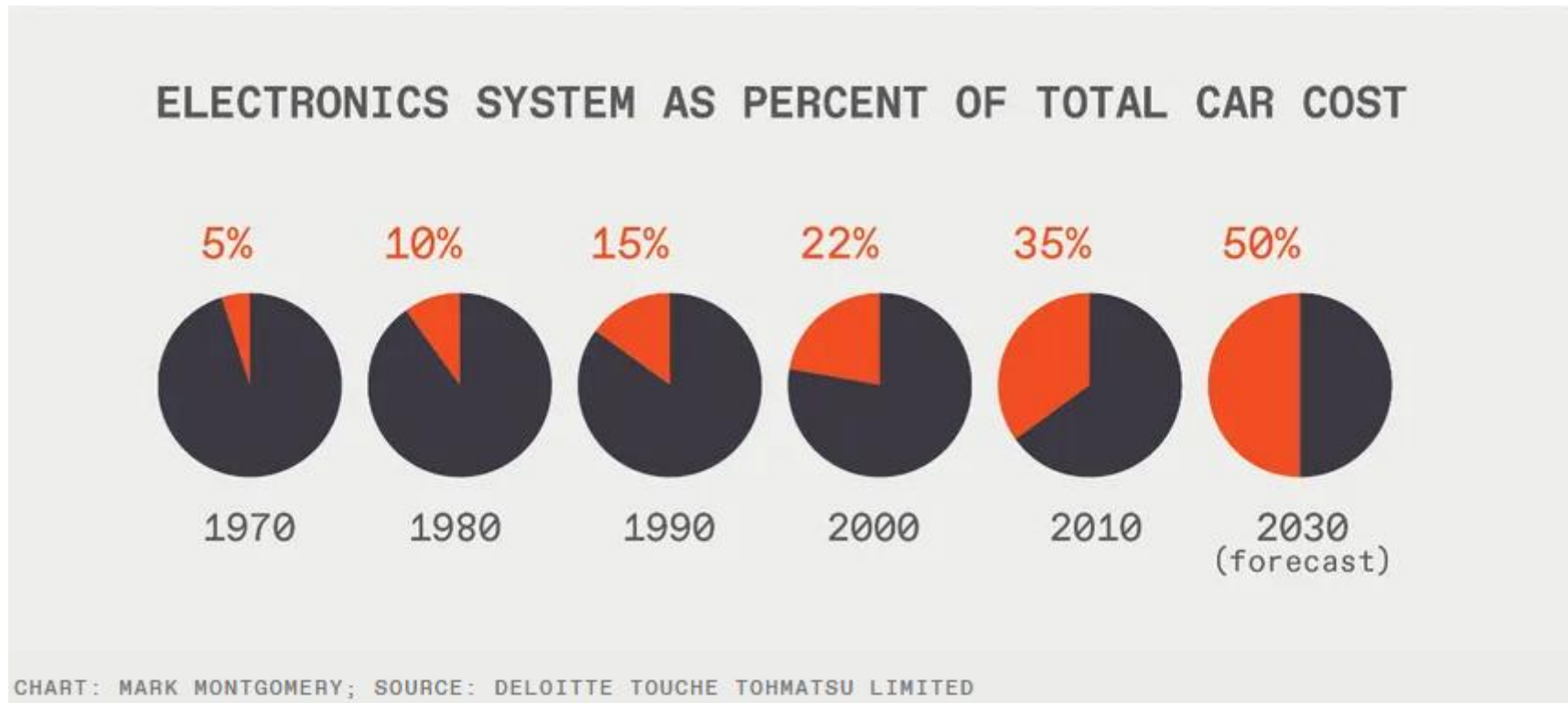Fulton Schools of Engineering

Arizona State University, Tempe, AZ, USA

Where rubber+software meets the road

- Not only are EV makers chasing the same limited number of customers, they are also pursuing an even more limited supply of software and systems engineers with smart mechatronics and robotics expertise. Software's complexity in current ICE vehicles is staggering, with many vehicles having 150 million lines or more of code. However, future EVs will likely have triple or more the lines of code as advanced autonomous driving features become available.

Source: https://spectrum.ieee.org/electric-cars

How Software Is Eating the Car

ELECTRONICS SYSTEM AS PERCENT OF TOTAL CAR COST

5%	10%	15%	22%	35%	50%
1970	1980	1990	2000	2010	2030 (forecast)

CHART: MARK MONTGOMERY; SOURCE: DELOITTE TOUCHE TOHMATSU LIMITED

Source: https://spectrum.ieee.org/software-eating-car

Data glut (perils of software complexity)

- Today's connected vehicles create up to 25 gigabytes of data per hour, a small portion of which is being shared outside the vehicle. However, by 2030, when vehicles could be interacting with scores or more external systems over a range of communication channels, that amount may reach four terabytes per hour, all of which will be captured, analyzed and monetized by multiple remote third-party systems.

Software engineering challenges

- Creating "smart vehicles" that sense, think, act and communicate in real time within a large transportation ecosystem, that use and generate vast volumes of data, that are increasingly electric powered, and that need to evolve their capabilities over time via over-the-air (OTA) software updates and upgrades represent a radically different system design paradigm for traditional auto manufacturers. The systems and software engineering challenges are materially more demanding. And creating reliable, interconnected, open, updatable and secure system-of-systems at scale is, to put it mildly, non-trivial.

Source: https://www.incose.org/docs/default-source/aboutse/se-vision-2025.pdf