Centralization potential of automotive E/E architectures

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Abstract

Current automotive E/E architectures are subject to big changes: Computing-power-intensive advanced driver-assistance systems, bandwidth-hungry infotainment systems, the connection of the vehicle with the internet and the consequential need for cyber-security drives the centralization of E/E architectures. A centralized architecture is often seen as a key enabler to master those challenges. Available research focuses mostly on the different types of E/E architectures and contrasts their advantages and disadvantages. There is a research gap on guidelines for system designers and function developers to analyze the potential of their systems for centralization. The present paper aims to make centralization potential quantifiable. To achieve this, we conducted a literature review and qualitative interviews with practitioners. From literature, we have identified seven automotive system properties reaching limitations in current automotive architectures: busload, functional safety, computing power, feature dependencies, development and maintenance costs, error rate, modularity and flexibility. The system properties are interpreted as quantitative evaluation criteria for an estimation whether centralization brings a benefit for the overall system performance. In the interviews, we have validated centralization and its fundament - the conceptual systems engineering - as capabilities to diminish the limitations. Based on this research, system designers can optimize their systems to face the previously mentioned challenges and avoid the evolution towards a monolithic architecture.

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