Traceability Analysis of a High-Level Automotive System Architecture Document

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Abstract: More and more functions in automotive systems are enabled and controlled by software that is distributed over a large number of systems and components. In addition, the systems are more and more interconnected to implement the desired vehicle functions. Creating and maintaining a high-level overview of the relations between vehicle functions, systems, and components in a complete and consistent way requires a lot of effort. On the other hand, such a high-level architecture is beneficial for planning the development, analyzing the architecture, or defining product variants. In this paper, we analyze a real-world document that was manually created to document all vehicle functions, systems, and components of one car series and relations between these. We formalized the content of this model by providing a model of the concepts and a set of consistency rules. By evaluating the consistency rules on the given document, we found 213 contradictory relations and 547 missing relations. Based on these results, we conclude that manually maintaining such high-level architectures is highly error-prone and should thus be supported by automation and appropriate tooling.

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