Chapter 2
Software Architectures: Views and Documentation

Abstract Software architecture is the foundation for automotive software design. Being a high-level design view of the system it combines multiple views on the software system, and provides the project teams with the possibility to communicate and make technical decisions about the organization of the functionality of the entire software system. It allows also us to understand and to predict the performance of the system before it is even designed. In this chapter we introduce the definitions related to software architectures which we will use in the reminder of the book. We discuss the views used during the process of architectural design and discuss their practical implications.

2.1 Introduction

As the amount of software in modern cars grows we observe the need to use more advanced software engineering methods and tools to handle the complexity, size and criticality of the software [Sta16, För10]. We increase the level of automation and increase the speed of delivery of software components. We also constantly evolve software systems and their design in order to be able to keep up with the speed of the changes in requirements in automotive software projects.

Software architecture is one of the cornerstones of successful products in general, and in particular in the automotive industry. In general, the larger the system, the more difficult it is to obtain a good quality overview of its functions, subsystems, components and modules—simply because of the limitations of our human perception. In automotive software design we have more specific challenge, related to the safety of the software embedded in the car and the distribution of the software—both distribution in terms of the physical distribution of the computing nodes and distribution of the development among the car manufacturers and their suppliers.

In this chapter we discuss the concept of software architecture and explain it with the examples of building architectures. Once we know more about what constitutes software architecture, we go into the details of different views of software architecture and how they come together. We then move on to describing the most common architectural styles and explain where they can be seen in automotive software. Finally we present the ways of describing architectures—the
architecture modelling languages. We end the chapter with references to further readings for readers interested in more details.

2.2 Common View on Architecture in General and in the Automotive Industry in Particular

The concept of architecture is well rooted in our society and its natural association is to the styles of buildings. When thinking about architecture we often recall large cathedrals, the gothic and modern styles of churches, or other large structures. One of the examples of such a cathedral is the “Sagrada Familia” cathedral in Barcelona with its very characteristic style.

However, let us discuss the concept of the architecture with a considerable smaller example—let us take the example of a pyramid. Figure 2.1 presents a picture of the pyramids in Gizah.

The form of the pyramid is naturally based on a triangle. The fact that it is based on a triangle is one of the architectural choices. Another choice is the type of the triangle (e.g. using the golden number 1.619 as the ratio between the slant height to half the base length). The decision is naturally based on mathematics and illustrated

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Fig. 2.1 All Gizah pyramids: a picture represents an external view of the product

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