As embedded systems evolve into more and more complex structures to meet the continuously increasing complexity of requirements, they face a variety of challenges. In particular, the involvement of multiple engineering disciplines targeting cross-cutting aspects of the system under development makes the situation even more challenging. Hence, there is a great need to establish a seamless modeling framework that on the one hand, facilitates reuse and automation, while on the other hand, is independent of any application domain. The modeling framework must provide appropriate models and description techniques for modeling the different aspects and artifacts of system development as well as methods and process techniques for creating and analyzing such artifacts. Therefore, this chapter introduces the SPES XT modeling framework, which aims to address these issues.
3.1 Introduction

From 2010 to 2012, the SPES modeling framework [Broy et al. 2012] was developed in a close collaboration between academia and industry. The SPES modeling framework, which is a structured collection of modeling concepts, enables the seamless model-based engineering of embedded software and relies on the core principles of divide and conquer and separation of concerns. The framework allows us to manage the complexity of modern embedded systems during the software engineering process. Furthermore, it allows us to apply formal methods for verification and validation purposes, which in turn, for instance, fulfills the need for safety-critical embedded software to work correctly.

The original SPES modeling framework already emphasized the use of the framework for documenting and analyzing certain quality aspects such as safety (see [Höfig et al. 2012]) and real time (see [Hilbrich et al. 2012]). However, in order to address the specific engineering challenges identified, the SPES modeling framework has been extended in two different directions:

- **Core methodological extensions** to address additional methodological aspects of a general modeling theory for embedded systems
- **Specific methodological extensions** to address specific engineering challenges in the engineering of embedded systems

The SPES XT modeling framework comprises the SPES modeling framework and, among others, three *core methodological extensions* to the original SPES modeling framework described in [Broy et al. 2012]:

- The **SPES XT Process Building Block Framework** allows the definition of customized engineering processes for specific purposes based on the artifacts defined in the SPES XT modeling framework (Section 3.3).
- The **SPES XT Context Modeling Framework** allows consistent documentation and analysis of properties or assumptions about the context of embedded systems and software (Chapter 4).
- The **SPES XT Systems Engineering Extensions** allow the SPES XT modeling framework to be applied within the overall systems engineering process for embedded systems including the