
Preface

Our modern society and technology are built on software. Critical embedded systems such as cars or factories, information systems such as ERP solutions or Internet search engines, or infrastructure such as utilities or telecommunications – none would work for even a second were it not for software. Most innovations today are shaped by software and nearly all businesses and industries are transformed by software. We can be quite sure that this will not change and software will continue to be at the core of major future changes. This relevance and dependence on quality software is what makes *software engineering* a key discipline for modern society. Software engineering is the discipline that aims at providing, evaluating, and improving methods, techniques, processes, and tools for the development of defect-free software that fulfills the needs of customers and users within time and budget constraints. Along with the growing importance of software, software engineering has also become a core field of modern research.

Since its inception in the 1960s, software engineering as a discipline has constantly grown and matured in many areas and in many ways. Today, it is a rich discipline with well-established research methods, consisting of many different subdisciplines. Of key importance to the development of a research discipline is always the underlying scientific approach. Here, the discipline has seen a major shift over the last three decades, as its formal foundations were successively augmented by a focus on empirical work aimed at evaluating whether research approaches do contribute value in real-world situations. This came to be known as empirical software engineering and is an important component of any modern software engineering research. One of the leading protagonists of empirical software engineering worldwide and certainly the leader in Germany in this subject is Dieter Rombach.

Prof. Dr. Dr. h.c. Dieter Rombach dedicated his entire career to furthering the cause of empirical software engineering as a discipline. In particular, his main research interests have always been in developing software with predictable quality. He has done intensive work on quantitative methods, languages, and tools to support software process and project management. This focus already became visible while he was working on his dissertation at the University of Kaiserslautern, Germany, where he conducted one of the largest controlled experiments ever – the development and maintenance of eight operating system kernels – to provide evidence regarding the benefits of a new structuring concept for maintainability. Ph.D. degree

in hand, he went to spend several years at the University of Maryland, where he worked with Victor Basili, who can be regarded as one of the founding fathers of empirical software engineering research. During this time, Dieter Rombach also worked as a project leader at the NASA Goddard Space Flight Center. In 1990, he received the Presidential Young Investigator Award of the National Science Foundation (NSF), USA. In 1992, he returned to the University of Kaiserslautern. His strong dedication to industrial cooperation directly led to the foundation of the Software Technologie Transfer Initiative (STTI), which later resulted in the creation of the Fraunhofer Institute for Experimental Software Engineering (IESE). This institute currently has about 200 employees and has been an important contributor to the international software engineering world for more than 15 years, exerting a strong influence in both research and industry. In particular, it has helped to significantly promote the concept of empirical software engineering. Beyond his personal impact and the impact of the institute he leads, he has achieved significant impact indirectly through the many students he has advised and taught over the years, including about 60 Ph.D. students.

For his many and important contributions to the field, Dieter Rombach has received numerous awards and recognitions, like the Service Medal of the State of Rhineland-Palatinate and the Federal Cross of Merit on Ribbon of the Federal Republic of Germany. He has also received an honorary doctorate degree from the University of Oulu, Finland, and was elected a Fellow by both the ACM and the IEEE Computer Society.

His impact on the software engineering landscape is amplified by his role as an expert, reviewer, and consultant to industry and as an advisor to different state, federal, and international bodies. Instead of going into more detail on his many achievements, we refer the reader to his bio.¹ Some things, however, cannot be found there, like his strong dedication to Kaiserslautern, his commitment to his favorite soccer team 1. FC Kaiserslautern, and many other things. They show that, while he spends numerous hours on software engineering, his interests are much broader.

This book is dedicated to Dieter Rombach and his contributions to software engineering in general and to empirical software engineering in particular. In fact, it was written to accompany a symposium in honor of his 60th birthday. But beyond this, its aim is to take stock of the current situation in software engineering and point out some visions for the future. This aim guided the concept of this book throughout. We introduce the book with a paper written by Dieter Rombach that provides a good overview of his vision for the empirical software engineering discipline. The remainder of the book is structured into three main parts: The first part focuses on what are generally considered the classical foundations of software engineering research, such as notations, architecture, and processes. The second part addresses the core part of Dieter Rombach's contribution – empirical software engineering – while the third part discusses the broader vision of the software engineering discipline, described along various dimensions. Contributions to this

¹http://www.iese.fraunhofer.de/en/aboutus/directors/cv_rombach_english.html

volume were collected on a by-invitation basis only. Invitations were sent to selected, internationally renowned researchers who have a relationship with Dieter Rombach's work and history. Due to the enormous network of collaborations that he has created over the years, the latter was hardly a restriction. Most of the authors invited promised a contribution right away, which now forms part of this collection. We are very happy about the numerous internationally acclaimed authors who did not hesitate to contribute to this collection. Without their contributions, this book would just not have been possible!

We augmented the collection with contributions by current members of Fraunhofer IESE to ensure that the research focus of Dieter Rombach, which is embedded in Fraunhofer IESE today, is adequately represented throughout this collection. As a result, we believe that this collection now provides an excellent overview of the current state of software engineering and its future directions and emphasizes the specific influences by Dieter Rombach and the research he cares about most.

A collection like this would never be possible without the help of many people. First of all, we would like to thank the numerous authors for their contributions. We know that it is not easy to make room in a busy schedule to be able to write profound contributions like the ones we received for this book, particularly within a tight schedule. The collaboration was simply exceptional! We would also like to thank Fraunhofer IESE as the sponsor of this book and several of its staff who greatly helped in preparing the book: Mrs. Nicole Spanier-Baro, who worked on the administrative issues and the accompanying symposium; Ms. Sonnhild Namingha, who did a great job of proofreading and editing; and Stephan Thiel, who worked relentlessly to get all the final formatting work done. We would also like to thank Christian Kröher from the University of Hildesheim for supporting us with LaTeX editing and Ralf Gerstner from Springer, who worked on the contract issues and supported us at every turn. Finally, we are grateful to Martin Verlage, who worked with us on the concept of the book and contributed a lot of ideas to our discussions.

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