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Models, Mindsets, Meta

The What, the How, and the Why Not?

Essays Dedicated to Bernhard Steffen on the Occasion of His 60th Birthday

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Young Bernhard and the Sea – Denmark, 1990 (Private photograph; used with permission)

Foreword

This Festschrift is dedicated to Bernhard Steffen on the occasion of his 60th birthday. The title, *Models, Mindsets, Meta: The What, the How, and the Why Not?*, reflects some of the guiding principles of Bernhard's functioning (in both his professional and his personal life): Once you choose to do something, question everything and generalize, especially when you need to specialize. In that case, generalize the meta-level. His contagious research enthusiasm, witnessed and enjoyed by his many scientific collaborators, is consistently driven by these principles. His scientific credentials are impressive, he initiated a number of novel research directions as well as solving a variety of technically challenging problems and transforming them into software solutions. In addition, Bernhard created "from scratch" an impressive research group at TU Dortmund.

The variety of his contributions is impressive. Always a neat theoretical framework, always made with some application in mind, and most of the time implemented in some software tool that turns out to be useful in practice. Often "in advance of his time": Dataflow analysis as model-checking as a proper semantic framework for program analysis and a starting point for software model-checking, he established a well-founded framework of service-oriented computing and verification before the term existed, model-based program generation as principle, and model extraction for legacy systems via automata learning: if you do not have a specification, then learn it.

Owing to the wide variety of topics in the contributions, reflecting Bernhard's versatile interests, the best way to organize the volume was along Bernhard's journey, by the locations where he met his colleagues, most of whom double as friends. As is seen on the cover image, Bernhard's journey is a may/must KTS, starting in Kiel but open ended. The may part comprises the various diversions to Uppsala, Cantoira, and ISoLA as a META-topos for symposia style inserts (in a sabbatical, on holiday, or at the ninth ISoLA) that combine research components with community and quality of life. The introductory paper by the editors, the 23 refereed full papers, and the two personal contributions showcase the wide recognition of his passion for science and his success in striving for excellence.

November 2018

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Personal Statement

To my dear friend and colleague Bernhard Steffen on the occasion of his 60th birthday!

One of the first emails I received from Bernhard, dated November 29, 1989, started as follows:

Congratulations!! Our paper was rejected! However, it was not rejected because it is bad, no because it is too theoretical. So, I submitted it just to LICS (slightly improved). If it gets accepted there, then I will be able to get over the rejection.

I hope Bernhard does not mind me sharing this with you, but it is really funny and perfectly illustrates his wry sense of humor and his ability to find humor even in the not-so-happy moments. And the good news is that our LICS submission did get accepted and so began our journey into the world of reactive, generative, and stratified models of probabilistic processes. It has been a great ride and I am very proud and happy to call Bernhard my dear friend and collaborator.

Cheers to you Bernhard on this very happy occasion. You are a remarkable person and scientist and I am so happy to have this opportunity to acknowledge you for all you have done.

Yours,
Scott Smolka

A Tribute to Bernhard Steffen

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It is a pleasure and an honor to congratulate Bernhard Steffen on the occasion of his 60th birthday. Bernhard's contributions are significant and span multiple fields. I have most appreciated Bernhard's support and friendship over the 30 years that I have known him.

I first met Bernhard in the late 1980s, when I was visiting Edinburgh University. Bernhard had come to Edinburgh from Kiel, where he had just completed his PhD. I remember Bernhard's enthusiasm, his impressive command of facts and results, and most importantly, his strong interest in contributing to the research being undertaken at that time in Edinburgh's Lab for Foundations of Computer Science (LFCS). In retrospect, it seems somewhat inevitable that Bernhard would fall in with Rance Cleveland and Joachim Parrow and help develop the Edinburgh Concurrency Workbench.

At that time, what struck me most strongly about my one-day meeting with Bernhard was his search to connect what he already knew well (data-flow analysis) with what the others in LCFS knew well (concurrency theory). It seemed as if Bernhard was on a "search" towards an "enlightenment" that only he could sense: there was a connection between his work and the work of the others, and time would make this clear.

The results of Bernhard's "search" were revealed to me in a surprising way some years later, in 1995: I had sabbatical leave from my position at Kansas State University and I spent one term at Carnegie Mellon University. By chance, Ed Clarke was offering a graduate seminar on model checking. Knowing little about the subject, I followed Ed's lectures. I was impressed by the use of fixed-point semantics and fixed-point calculation algorithms for both defining and checking properties of state-transition systems. The methodology looked familiar, almost uncomfortably familiar, but I couldn't quite explain why I had that feeling.

I wanted to learn more: I spent much of my time that term in the CMU Computer Science library, reading everything I could find on model checking. It was there that I encountered Bernhard's 1993 Science of Computer Programming article, *Generating Data Flow Analysis Algorithms from Modal Specifications*. That paper held the explanation for which I was searching—all the connections that I had sensed between model checking and data-flow analysis were there in that article, neatly expressed in the box-diamond notation of branching-time temporal logic *augmented with reverse modalities*. At that instant, I recalled the discussion I had with Bernhard that one day in Edinburgh—there was indeed an "enlightenment" that Bernhard had sensed and had achieved.

The next step for me was to apply this enlightenment to the area in which I worked. Using abstract-interpretation-based domain theory, I conceived models of behavior trees whose properties could be expressed in box-diamond notation. Using Bernhard's explanation of data-flow-analysis-as-model-checking, I was able to generate abstract interpretations mechanically from the box-diamond formulas I had written. It was also easy to see how the notations could define the classic, equationally-stated forms of data-flow analysis. Here was truly a unified theory of property specification and implementation.

Bernhard's work changed the direction of my research and led to many years of results. I was honored when Bernhard contacted me in 1997 with a critique of my attempts to apply his insights. In a subsequent meeting in Italy in 1998, Bernhard suggested that we work together to develop further lines of research that followed from his work.

The collaboration between Bernhard and me lasted well over a decade, and it expanded to include Bernhard's research group in Dortmund and the programming-languages research group in Kansas. The collaboration went well beyond authorship of jointly developed papers: it became a long-term exchange and development of research directions, perspectives, and goals. The collaboration meant that I made many visits to Dortmund and stayed at Bernhard's and Tiziana Margaria's home. I enjoyed coffee from Bernhard's impressive espresso machine, I took long walks with Tiziana and Bernhard in the forest next to their home, and I watched their children, Barbara and Bruno, grow to adulthood.

My technical expertise expanded greatly from interactions with Tiziana, Markus Müller-Olm, Jens Knoop, and Oliver Rüthing, and the other members of the Dortmund research group. And members of the Kansas group, notably, John Hatcliff and Matt Dwyer, also became part of the research "family," a family that functions to the present day in the *International Journal on Software Tools for Technology Transfer* and the *ISoLA* conference series.

Bernhard has always impressed me with his enthusiasm for work, his unending desire to transfer his results into the technology mainstream, and especially by his sureness of vision. Throughout his career, Bernhard has always followed a path of certainty towards an "enlightenment" of how software specification, analysis, and implementation should be undertaken. It is this sureness of vision that motivates and justifies the tributes that Bernhard now receives on the occasion of his 60th birthday.

Bernhard, congratulations, and may your vision of computer science continue to lead us for years to come!

Contents

Aachen 1990–1993

Passau 1993–1997

Dortmund 1997 – Today