

# Preface

The authors of this book first met in the context of a master project in Philips Research in Eindhoven, the Netherlands, back in the summer of 2004. One was a student in Computer Science and Engineering from Lund University of Technology in Sweden, and the other a principal research scientist, leading the team of researchers designing a predictable network-on-chip called *Æthereal*. The work on the network-on-chip had been going on for several years, and the team had realized that predictable system-level guarantees also required a predictable solution for the memory system, which was the topic of the master project.

Inspiration for the memory controller designed in this project was found in two different groups within Philips. One group made statically scheduled SDRAM controllers for high-performance video pipelines with firm real-time requirements, which inspired the idea of precomputed memory patterns. The other group made dynamically scheduled memory controllers for digital TV and set-top boxes, requiring dynamic scheduling to reduce latencies of latency-sensitive memory clients. The memory controller proposed in this book is a hybrid design that combines the approaches of these groups by dynamically scheduling statically computed memory patterns. From these two groups, the authors would particularly like to thank Frits Steenhof and Ad Siereveld for the inspiration and creative discussions.

At the end of the 9 month master project, it was clear that only the surface of a large research topic had been scratched and that much interesting work remained to be done. An opportunity to continue the work in the Electronic Systems group at Eindhoven University of Technology presented itself through a Philips-funded PhD position in the PreMaDoNa project. The bulk of the research presented in this book was carried out in the scope of this project during the following 4 years and resulted in a thesis, several publications, and both a simulation model and a hardware implementation of the memory controller integrated in a design flow. This would not have been possible without the contributions from several master students. Thank you Markus Ringhofer, Eelke Strooisma, Getachew Teshome, Williston Hayes, and Winston Siauw for your hard work and for all the good times. The authors also

express their gratitude to Prof. Lambert Spaanenburg and Prof. Jef van Meerbergen for being the key enablers of the master project and the PhD project, respectively.

During the PhD project, parts of Philips Research turned into NXP Semiconductors, and the research on the *Æthereal* network-on-chip finished. The fruits of this research were combined with processor tiles featuring Silicon Hive VLIW cores and MicroBlaze cores, resulting in the CoMPSoC platform and design flow. This effort demonstrated that it was possible to design a predictable and composable platform capable of concurrently executing a mix of real-time and non-real-time applications. Since then, this platform has been extensively used both as a research vehicle and for embedded system education at Eindhoven University of Technology, Delft University of Technology, and NXP Semiconductors.

For every door you close in research, another one opens. Both authors of this book are currently employed at Eindhoven University of Technology extending the work on the CoMPSoC platform and the predictable and composable memory controller. The authors express their gratitude to all the members of the CoMPSoC team, and in particular to those contributing to the memory controller research. Thank you Karthik Chandrasekar, Firew Siyoum, Anand Khot, Sven Goossens, Tim Kouters, and Manil Dev Gomony, for continuing to push the boundaries of real-time memory controllers.

Hard and passionate work takes its toll and sacrifices evenings and weekends when required. The authors are grateful for the support from family and friends, in particular for the friendship and help from Andreas Hansson. Finally, Benny acknowledges the support of his wife María Eugenia Martelli, whose love and understanding made this journey easier and more enjoyable.

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