Community Experience Distilled

Clojure High Performance Programming

Understand performance aspects and write high performance code with Clojure

Shantanu Kumar

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About the Author

Shantanu Kumar is a software developer living in Bangalore, India, with his wife. He started learning programing in 1991, using BASIC on MS DOS when he was at school. There, he developed a keen interest in the x86 hardware and assembly language, and he dabbled in it for a good while. Later, he programmed professionally in various business domains and technologies while working with the Indian Air Force and several IT companies.

In recent years, Shantanu has worked on high performance and distributed systems. Having used Java for a long time, he discovered Clojure in early 2009 and has been a fan ever since. Clojure's pragmatism and fine-grained orthogonality continues to amaze him, and he believes he is a better developer because of this.

When not busy with programming or reading up on technical subjects, he enjoys reading non-fiction, riding his bike, and occasionally just lazing in his free time. Shantanu is an active participant in the Bangalore Clojure users group and develops several open source Clojure projects on GitHub.

Acknowledgments

I would like to thank Rich Hickey for creating Clojure and making it available as open source, and for his awesome talk videos. I would also like to thank Alex Miller for arranging so many Clojure talks and for making their videos accessible to all; and Alex Ott, Michael Klishin, and others from the Clojure community for their hard work in making Clojure documentation aggregated and available.

While I was working at the Bangalore office of Runa (now Staples Lab) earlier, several colleagues shared valuable input about Clojure performance. Most notably, Zach Tellman shared his insight about Clojure and JVM performance, Isaac Praveen and Abhijith Gopal shared a great deal of information about Clojure application behavior under load, and Philippe Hanrigou shared his ideas about high performance API design and queue systems. I want to thank all of them.

This book would not have become a reality without the fine people at Packt Publishing. I would like to thank Ashvini Sharma for contacting me and convincing me to take up writing this book, Anish Ramchandani and Amey Sawant for coordinating the writing process, and the Commissioning Editors Meeta Rajani, Llewellyn Rozario, and Priyanka Shah for shaping up this book as I engaged in my debut writing. Technical Editors Jalasha D'costa and Monica John helped me disambiguate and refine the language in this book. I also owe my gratitude to the technical reviewers Jan Borgelin, Mimmo Cosenza, Paul Stadig, and Miki Tebeka – their feedback made the content so much better. Any errors or omissions, however, are only due to me.

Writing this book has been an arduous task. I want to thank my wife Binita for putting up with me while I was immersed far too many days, nights, and weekends into the book. If not for her support, I would not have been able to do justice to this book.

About the Reviewers

Jan Borgelin is the co-founder and CTO of BA Group Ltd., a Finnish IT consultancy providing services for global enterprise clients. With over 10 years of professional software development experience, Jan has had the chance to work with different technologies and programming languages in international projects where performance requirements have always been critical to the success of the project.

Mimmo Cosenza aka Magomimmo is a programmer and entrepreneur living in Milan, Italy. In the eighties, after graduating in Philosophy of Language, he worked for Rank Xerox and IBM. Then, he joined the Artificial Intelligence lab of ENI S.p.A, the Italian national oil company.

He designed and developed very successful LISP-based applications for the exploration and production departments of ENI. In 1995, after having been in Los Angeles during the rise of the Internet, he founded Sinapsi—an Italian software boutique. In his own country, he is very well known for his involvement in open source communities. In 2012, he founded SmartRM Inc., a startup that applies the Digital Right Management technology for protecting privacy to share confidential information without losing the control of their circulation.

He loves to teach the art of programming. He is the author of *Modern-cljs,* an open source book on the Clojure and ClojureScript programming languages. The book is hosted on `https://github.com/magomimmo/modern-cljs`.

Currently, he is applying machine learning techniques to Big Data by using Clojure on the server-side and ClojureScript on the client-side.

Paul Stadig is a professional software developer living in Crozet, VA, with his wife and three children. He has a B.S. and an M.S. in Computer Science from George Mason University, and he has 16 years of software development experience. He has an insatiable curiosity about the world in general and about programming languages in particular.

He has been involved in the Clojure community since 2008, he was a reveiwer for the first edition of *Programming Clojure*, and he is also a contributor to the language. Since 2010, he has been employed at Sonian, where he builds cloud-based distributed systems in Clojure.

Miki Tebeka has been shipping software for more than 10 years. He has developed a wide variety of products from assemblers and linkers to news trading systems and cloud infrastructures. Miki currently works on the data pipeline at Demand Media. In his free time, Miki is active in several open source communities.

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Preface

Clojure is a remarkably high-performance language despite its dynamic nature. What really strikes you though is the fact that it combines performance with fundamental simplicity and pragmatism, which makes it such a joy to program in. Over the last six years since its first public release, Clojure has been heavily tested and deployed in production by many people and organizations across various domains. Its user base has grown rapidly during this period.

Clojure High Performance Programming is all about Clojure running on the Java Virtual Machine. The JVM has a reputation of being a robust platform to develop and deploy applications on. In this book, we take a deeper look at the performance characteristics of various features of Clojure and the underlying environment. We also explore what it takes to build well-performing software. We begin with the performance fundamentals and gradually proceed over to Clojure and other matters you may have to deal with while writing high-performance applications.

Understanding and achieving performance is both an art and a science, just like writing good software. Remember the big picture in the back of your mind but also be prepared to get into the details with measurement tools. More importantly, know how the software works and keenly study the environment in which it runs. I hope this book will help you on that path.

What this book covers

Chapter 1, *Performance by Design*, classifies the various use cases with respect to performance and analyzes how to interpret their performance aspects and needs.

Chapter 2, *Clojure Abstractions*, is a guided tour of various Clojure data structures, abstractions (persistent data structures, vars, macros, and so on), and their performance characteristics.