The ever-increasing complexity of *in silico* experiments in computational science is reflected in the growing complexity of the simulation software enabling these experiments. However, computational scientists rarely employ state-of-the-art software engineering methods, which negatively affects their productivity as well as the reliability of their scientific results. To tackle this challenge, this book introduces the Sprat Approach, which hierarchically integrates multiple domain-specific languages to facilitate the cooperation of scientists from different disciplines and to support them in creating well-engineered software without extensive software engineering training. To evaluate the Sprat Approach, it is applied to the implementation of the Sprat Marine Ecosystem Model in an exploratory case study.

The Sprat Marine Ecosystem Model is a novel end-to-end ecosystem model based on population balance equations. In order to evaluate the Sprat Model, it is parametrized for the eastern Scotian Shelf ecosystem with its intertwined direct and indirect fish stock interactions, which previously could not be modeled satisfactorily. The simulation results described in this book provide new insights into the main drivers of regime shifts in marine ecosystems.

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Model-Driven Software Engineering for Computational Science Applied to a Marine Ecosystem Model

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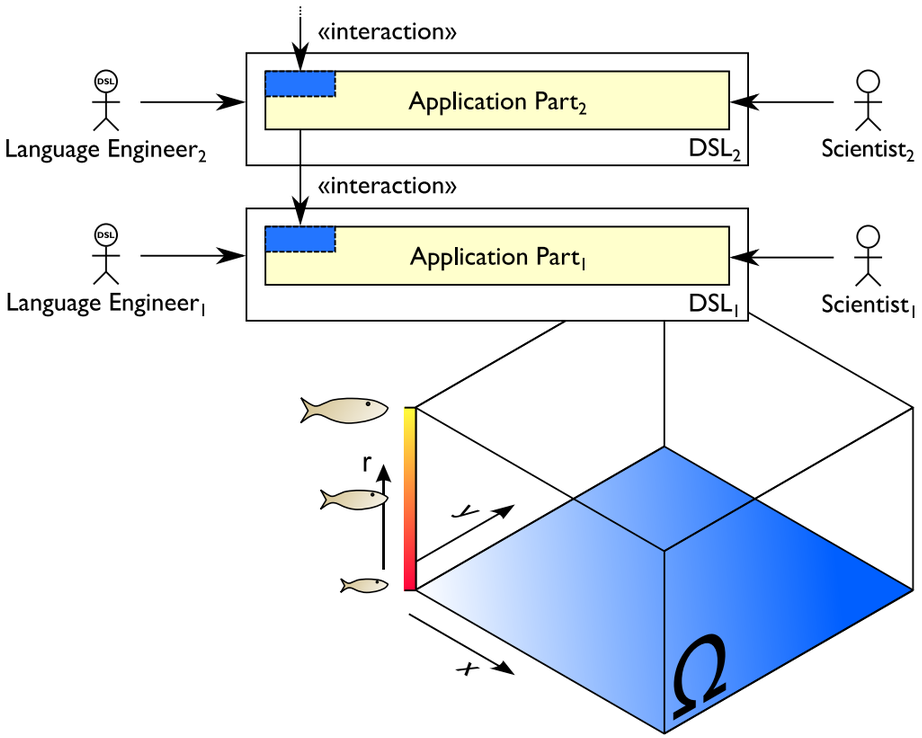

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