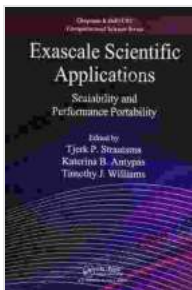# Scalability and Performance Portability: Redefining Computational Science

In the rapidly evolving landscape of computational science, scalability and performance portability have emerged as indispensable factors for pushing the boundaries of scientific discovery. This comprehensive book, published by Chapman and Hall/CRC Computational Science, provides an in-depth exploration of these crucial concepts, offering a wealth of practical techniques, real-world examples, and expert insights to empower computational scientists.

Exascale Scientific Applications: Scalability and Performance Portability (Chapman & Hall/CRC Computational Science) by Timothy J. Williams

★★★★★ 5 out of 5

Language	: English
File size	: 33762 KB
Text-to-Speech	: Enabled
Screen Reader	: Supported
Enhanced typesetting	: Enabled
Print length	: 587 pages

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Chapter 1: Understanding Scalability

The book begins by laying the foundation for scalability, explaining its significance in tackling complex computational challenges. It delves into different types of scalability, including weak scaling, strong scaling, and load balancing. Through clear discussions and illustrative examples,

readers gain a thorough understanding of the principles underlying scalability.

Chapter 2: Performance Portability

Chapter 2 shifts the focus to performance portability, which ensures that computational applications can be efficiently executed across diverse hardware platforms. The authors introduce the concept of performance portability and its challenges, examining various approaches to optimize code for different architectures. Case studies and practical examples showcase the benefits of performance portability.

Chapter 3: Parallel Programming Paradigms

As computational science increasingly leverages parallel computing, the book dedicates a chapter to parallel programming paradigms. It covers a range of topics, including shared memory programming, distributed memory programming, and hybrid programming models. Readers learn about the strengths and limitations of each paradigm, enabling them to make informed choices for their computational needs.

Chapter 4: Scalable Algorithms

Chapter 4 explores scalable algorithms, essential for exploiting the full potential of modern computational resources. It introduces fundamental algorithms and data structures, focusing on their scalability characteristics. Practical examples illustrate how to design and implement scalable algorithms for real-world problems.

Chapter 5: Performance Analysis and Optimization

To ensure optimal performance, the book covers performance analysis and optimization techniques. Readers learn about performance metrics, performance profiling tools, and strategies for identifying and eliminating performance bottlenecks. Case studies demonstrate the effectiveness of these techniques in improving the performance of computational applications.

Chapter 6: Case Studies in Scalability and Performance Portability

The book culminates with a chapter dedicated to case studies that showcase the practical application of scalability and performance portability. These case studies cover various scientific domains, including climate modeling, computational biology, and astrophysics. They provide valuable insights into how researchers have successfully tackled complex computational challenges.

With its comprehensive coverage, practical examples, and expert insights, "Scalability and Performance Portability: Chapman Hall CRC Computational Science" is an essential resource for computational scientists seeking to enhance the scalability and performance portability of their applications. It provides a valuable roadmap for navigating the complexities of modern computational environments, enabling researchers to push the boundaries of scientific discovery.

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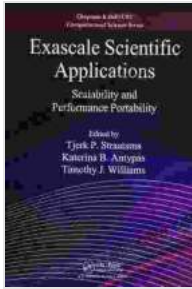
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