BIOGRAPHICAL SKETCH

Md Bulbul Sharif was born in Bangladesh, a beautiful country in South Asia. He received his B.S. in Computer Science and Engineering in 2016 from the Bangladesh University of Engineering and Technology. He started his graduate studies at Tennessee Tech University in 2017. His research interests include High Performance Computing, Parallel Application, Performance Portability, and Productivity.

EDUCATION

Ph.D. in Computer Science
Tennessee Tech University, 2017-2022 (expected)

B.S. Computer Science and Engineering
Tennessee Tech University, 2011-2016

College of Engineering

TENNESSEE TECH

The Department of

Computer Science

Announces the Dissertation Defense

of

Md Bulbul Sharif

In Partial Fulfillment of the Requirements

For the degree of

Doctor of Philosophy in Computer Science

July 1, 2022

2 p.m. (CST)

Tennessee Tech University

Zoom Link: https://tntech.zoom.us/j/9730639578

FIELD OF STUDY

Computer Science

Subfields: High Performance Computing

DISSERTATION TOPIC

AN ADVANCE FRAMEWORK TOWARDS PERFORMANCE PORTABILITY AND PRODUCTIVITY FOR ITERATIVE STENCIL APPLICATIONS IN HPC ENVIRONMENTS

EXAMINING COMMITTEE

Dr. Sheikh Ghafoor (Chairperson)

Dr. Michael Rogers

Dr. Douglas Talbert

Dr. William Eberle

Dr. Alfred Kalyanapu

ABSTRACT

Portability, performance portability, and productivity of parallel applications on heterogeneous architectures are very challenging problems. Moreover, with the evolution of new architectures and machines, it becomes more challenging to implement a parallel application that can easily port into all platforms and provides almost similar performance compared to targeting that platform. Programming for different heterogeneous systems is a notoriously critical task mainly because most of the existing programming models for such systems only provide low-level platform-specific abstractions. The lack of high-level unified programming models forces the programmer to learn multiple distinctive models for parallel computing. In addition, most of the high-performance applications (e.g., Simulations) are computationally intensive and sometimes require millions of core hours to do even a small and realistic run. However, most of these have common computational characteristics like stencil computation, data parallelism, and inter-process communication. Thus, the challenges behind developing such an application require domain expertise, a deep understanding of heterogeneous architectures, and a capable machine. This work aims to provide a uniform application programming interface for heterogeneous systems that is portable, performance portable, and productive. Another goal of this research is to provide a simple, user-friendly meta-computing API so that domain scientists can access efficient hardware without needing the level of expertise required today. To this end, this work first provides a survey by reviewing existing works in the context of the problems. Next, this research considers three significant aspects of an advanced parallel programming framework. The first problem addresses the challenges of porting parallel code to the new architectures. The second problem studies performance portability and how to achieve it. The objective of the third problem is to formulate productivity. Finally, the end goal of this research is to provide a high-level programming framework that solves all three problems discussed above and makes life easier for domain scientists to focus more on the application instead of concerning rewriting the code or optimizing for new architectures.