A Framework for Low-Communication 1-D FFT

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Abstract:  
In state-of-the-art high-performance computing on distributed-memory systems, communication often represents a significant part of the overall execution time, and quite likely consumes a major share of the total energy used. For distributed 1-D FFT, every industry-standard implementation performs three all-to-all internode data exchanges which make up the bulk of communication. We present here a mathematical framework for deriving a family of easy-to-implement single-all-to-all 1-D FFT algorithms. Furthermore, our framework allows tradeoff between accuracy and performance. Depending on the problem size and the computer system used, implementations at comparable accuracy based on our new approach can outperform leading FFT libraries by as much as twofold, higher still if reduced accuracy is acceptable.

Bio:  
Peter Tang received his PhD in applied mathematics from the University of California at Berkeley in 1987. He has been at Intel since early 1999, except for a 3-year stint (08-11) at D. E. Shaw Research help building their second-generation special-purpose supercomputer for molecular dynamics simulation. Peter’s main interest is in computational algorithms including design, implementation, and analysis as well as various aspects of computer arithmetic. Peter was the main designer of the IEEE decimal floating-point encoding format, the so called “Intel” format, or BID format, which is one of the two encodings specified in IEEE-754-2008. Peter’s recent focus is on FFTs and various linear algebra algorithms strategic to Intel.