

Evaluation of the VSIPL++ Serial Specification Using the DADS Beamformer

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The High Performance Embedded Computing Software Initiative (HPEC-SI) Development Working Group has been creating VSIPL++, a new software standard to promote portability, productivity, and performance in embedded parallel systems. This standard expands the Vector Signal Image Processing Library (VSIPL) to encompass parallel systems in C++. HPEC-SI has contracted with CodeSourcery, LLC, to produce a VSIPL++ Reference Library. The Reference Library is intended to allow early users to experiment with the functionality of VSIPL++.

This presentation discusses a project to evaluate the VSIPL++ specification by using the CodeSourcery VSIPL++ Reference Library to implement a part of the current operational signal processing code for the Deployable Autonomous Distributed System (DADS). The authors of this presentation have extensive experience in developing and using the original VSIPL library, working with parallel signal processing algorithms, and developing other HPC middleware and standards. They have been involved with the development of the VSIPL++ standard, but are not C++ programming experts. One aspect of this work will be to compare features and ease-of-use of VSIPL and VSIPL++.

The Deployable Autonomous Distributed System (DADS) is an advanced development program, sponsored by ONR-321, to demonstrate deployable autonomous undersea technology for operations in coastal waters. The system consists of small acoustic arrays on the ocean floor with embedded in-node signal processing. Detections are transmitted to the surface using acoustic modems.

The current DADS acoustic beamforming software is written in ANSI C, is available in both development and embedded configurations, and is unclassified. The code is sequential, but future hardware and algorithm upgrades could require parallelization. Of several candidate software modules, the beamformer was chosen as most appropriate for conversion to VSIPL++. The DADS beamformer does either adaptive processing (using a minimum variance distortionless response algorithm) or conventional beamforming. The beamformer source code consists of about 1000 lines of non-blank, non-comment code.

The project established a test data set and an environment in which the current DADS beamforming code could be executed. The code was then rewritten in C++ using the CodeSourcery VSIPL++ Reference Library and the results of running the new code were verified. Metrics were recorded on the time to develop the code and the resulting changes in lines of code from the original version.

We will report on these metrics and other lessons learned. Of particular interest will be whether addressing real-world algorithms exposes any functional problems or deficiencies of the VSIPL++ specification that should be addressed by the HPEC-SI Working Group.