A Flexible Software Architecture for High Performance Synthetic Aperture Processing

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Introduction
Array has developed a novel software architecture, for implementation at the Swedish Naval Underwater Sensors Analysis Centre (MUSAC), which enables users and scientists to easily construct new applications by using a "Lego" style technique. The technique provides the user with building blocks of processing functions that are selected, one by one, in order to graphically modify existing applications or to construct new applications. Array's unique design then parallelizes the application, for immediate processing on a cluster of processors. This design offers many flexible features: users can easily construct or modify applications; users can design new building blocks and integrate them without recompiling the original system code; the system can be effortlessly scaled simply by adding more processors. In addition to offering flexibility for sonar applications, such as Synthetic Aperture Sonar (SAS) and Matched Field Processing (MFP), this new design has already been successfully used to parallelize Synthetic Aperture Radar (SAR) processing on a Beowulf cluster.

A Scalable and Flexible Software Architecture
Array's Generic Signal Processor (GSP) is scalable and flexible. The scalability allows processors to be added or removed, without need to recompile the existing software. This gives the user the ability to boost system performance when new high performance processors are available in the marketplace, extending the life of the system.

Features and Benefits
- An Open System using Open Source and Open Standards: Linux, MPI and VSIPL
- Object-Oriented Auto-Scaling Generic Signal Processor Software
- Automatic Load Balancing
- Full-Featured Support for Sonar Post Analysis Systems
- Extensive Support for Synthetic Aperture Processing
- A Practical Framework for Truly Rapid Prototyping

Universal Beamformer
The Universal Beamformer accepts data from a wide variety of sensors, both active and passive, and allows the user to beamform data from sensors configured to any geometry. Both time and frequency domain beamforming are supported.

Future Directions

Array has developed a new software architecture for high performance computing that allows developers and end-users to use Moore’s law to their advantage.

The robustness and fault tolerance of this architecture make it ideal for the following applications:
- Software Defined Radio (SDR)
- Spaceborne GMTI
- Smart Antennas

*Perhaps the central problem we face in all of computer science is how we are to get to the situation where we build on top of the work of others rather than redoing so much of it in a trivially different way.*
R.W. Hamming, 1968