Atmospheric and Environmental Research

The Algorithm Workbench

A toolkit supporting transition of science algorithms from research to operations

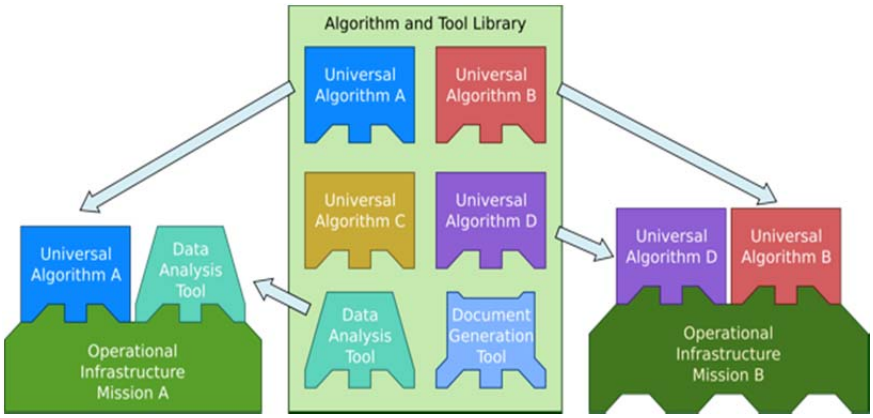
The Challenge

Remote sensing ground processing systems have historically been single-use designs tailored to the specific mission requirements and instruments. While the larger processing architecture may employ certain standards available at the time the system was developed, they do not incorporate an open and standardized software architecture at the algorithm level. As a consequence, these systems face high costs and long delays transitioning new science algorithms to operations. As defect corrections and improvements are implemented, operational algorithms become disjoint from the development/science versions, complicating algorithm support, problem resolution, and incorporation of new science into operations. Finally, despite a common underlying science basis, separate algorithms are developed for different missions that must be maintained separately further adding to cost and complexity of support.

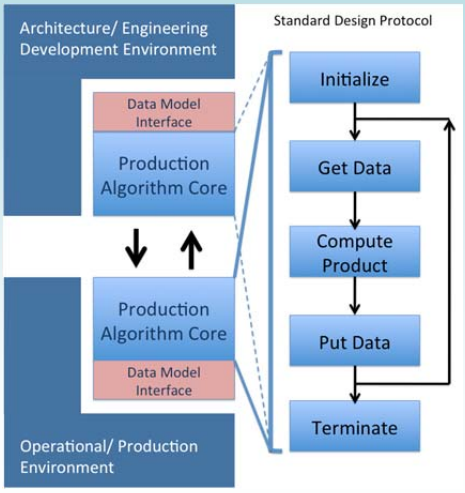
The Solution

The Algorithm Workbench (AWB) is designed to provide a common set of interfaces and an underlying infrastructure to support the entire algorithm lifecycle from initial scientific exploration and design, through development and test, all the way to operations. A key element is an open data model interface (DMI) that provides a standard mechanism for interfacing science algorithms to the underlying infrastructure. Algorithms written to this DMI can be seamlessly moved between disparate processing environments. The AWB is designed to support development of a common algorithm and tool-set library capable of supporting multiple missions and environments. Algorithms in the AWB behave as software components with properties defined in an Algorithm Descriptor Database (ADDB), In addition, the AWB also promotes algorithm "buy back" from the operational to development environment which facilitates continued algorithm improvements and their transition to operations based on a shared baseline. The AWB is an important element of an overall algorithm lifecycle management process.

Universal Algorithm and Tool Library



The Algorithm Workbench Concept



Features & Benefits

Standard Design Protocols– structured methods for algorithm design and implementation

- ✓ *Speeds up development and migration*
- ✓ *Allows for algorithm "buy-back"*

Data Model Interface – standard APIs for sensor and meta-data access

- ✓ *Insulates algorithm from underlying data formats and physical environment*
- ✓ *Allows for seamless sharing of test data across development and operational environments*

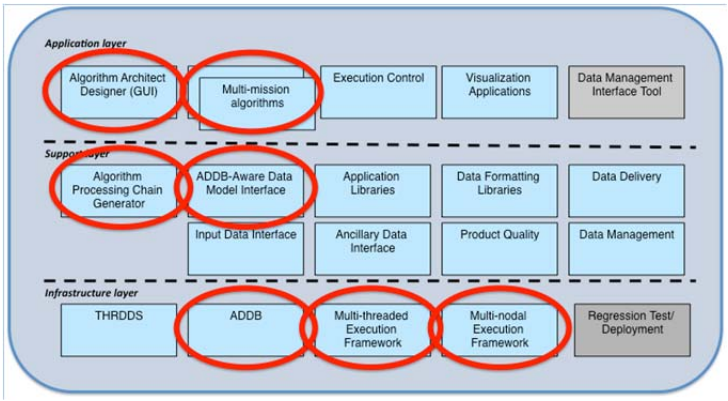
Algorithm Descriptor Database – programmatically-accessible database of algorithm and data characteristics

- ✓ *Allows automated generation of algorithm trees*
- ✓ *Provides interfaces for algorithmic analysis of processing systems, and machine generation of program-specific documentation*

Architecture Overview

The algorithm workbench employs a layered architecture designed to allow the substitution of individual components to meet the specific needs of system integrators. The baseline distribution includes a complete processing infrastructure, as well as monitoring and visualization tools, and can be used directly to run available algorithms. The Algorithm Workbench is designed to work with a variety of existing off-the-shelf tools, and the substitution or modification of a single component will not change the user's ability to leverage the capabilities of all other components.

The system is designed for easy, user-driven addition of algorithms and tools. Scientific algorithms are packaged to use the DMI to read and write all data, and are accompanied by an ADDB fragment file. These two elements are all that is required to fully-integrate the algorithm into the Algorithm Workbench system, and will allow all tools to analyze, describe, and run the algorithm software.



Component	Approach
Algorithm Descriptor Database (ADDB)	Contains description of all algorithm inputs, outputs, dependencies
Data Model Interface	Standardized DMI for all between algorithms and processing infrastructure
Processing Chain Generator	Automatically install algorithm processing chains into selected execution environment
Algorithm Architect Designer	Interactive tool enables wide range of users to configure algorithm chains for testing and production
Execution Environments	Variety of execution environments all share common Interfaces (e.g., DMI) – enable portability
Universal algorithms	Componentized algorithms support DMI with characteristics defined in ADDB

About Atmospheric and Environmental Research

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