Fraunhofer ITWM

Fraunhofer-Institut für Techno- und Wirtschaftsmathematik ITWM

Aloma – a Framework for Next Generation Seismic Applications

Based on GPI-Space Technology

ALOMA is a runtime environment and auto-parallelization framework that helps tackle the challenge of making seismic applications run efficiently on large scaled distributed systems.

ABOVE. Example workflow from the graphical workflow editor tool

Auto-Parallelization Framework

As surveys are getting larger and larger, systems must grow more and more, and developers need to efficiently make use of distributed resources.

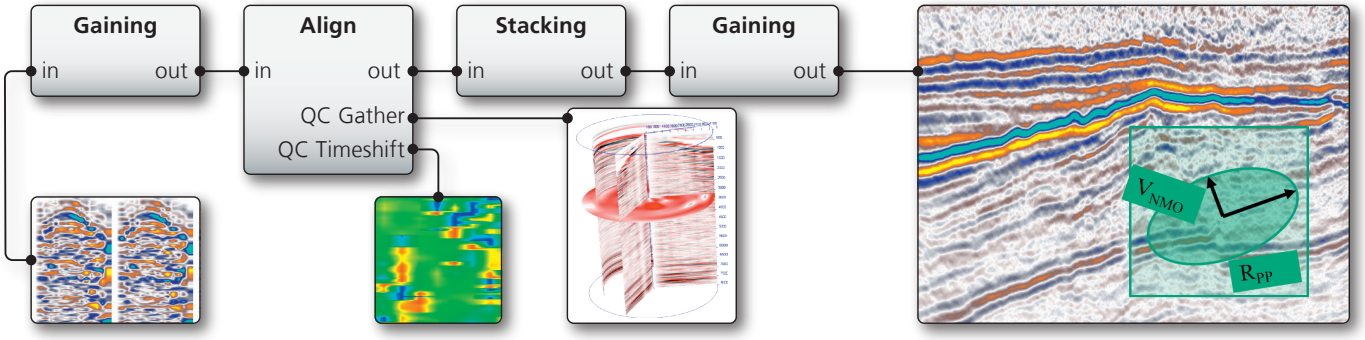
For most geoscientists, this is way outside their area of expertise. They should be able to focus on the geophysics in algorithms and not have to worry about parallelization, multi-threading, and other challenges in high-performance computing.

This is the fundamental idea behind ALOMA: to free the geoscientists from having to learn about HPC tools and strategies in order to execute their software in a scalable way. To achieve this goal, Fraunhofer developed a system that sits in between the Seismic and the HPC experts. Computer- and geo-scientists together came up with ideal strategies for parallelization and data partition in the context of geophysical applications.

Module Integration

The heart of ALOMA, its failure tolerant runtime system to execute workflows on distributed systems, was then developed by HPC experts. For its users, the geophysicists and geologists, ALOMA is merely a black box in which they integrate their developments via a well-defined interface. New algorithms and prototypes can be added and tested to production scale within no time.

For production use, existing codes and applications – even in different programming languages such as C/C++, Fortran, Python, Matlab etc. – can be integrated as modules in ALOMA.



Exemplary workflow with ALOMA: A volume of input gathers is aligned and stacked to a volume. Pre- and Post-Processing are added and intermediate results relevant for QC can easily be extracted.

Main features

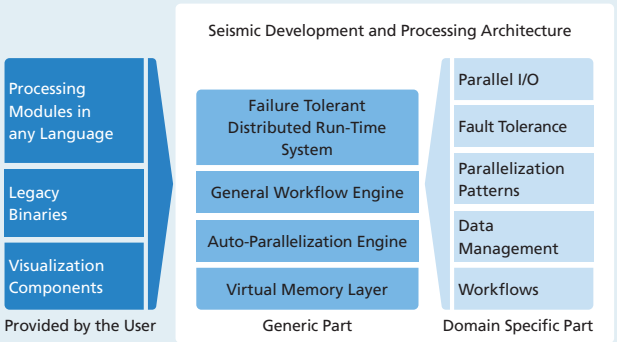
- Plugin architecture for easy integration of:
  - Existing algorithms in different programming languages
  - Existing binaries without requiring the source code
  - Newly developed algorithms for tests on production scale
- Graphical interface to create even the most complex workflows in a user-friendly manner
- Command-line interface for most of the available functionality including the batch processing of workflows
- Parallel runtime execution system that parallelizes across all available resources
- Automatic adaption of data dependencies between modules in a workflow
- Integrated 2D viewers for QC of results
- Projects and data management backed by a SQL database
- Fault-tolerant-execution with automatic rescheduling of failed tasks

Machine Learning based processing tools

- Parallel execution of deep neural networks inference
- Fully integrated over the ONNX runtime (other frameworks possible)
- Using the ONNX format for machine learning models
- Easy integration of proprietary machine learning algorithms
- Trim statics align and auto-muting
- Goal: Full processing toolkit based on machine learning

GPI-SPACE – At the intersection of HPC and Big Data

- Advanced memory management
- Data streaming
- Integration of legacy codes
- Failure tolerant execution
- Dynamic resource management



Please find more information on www.itwm.fraunhofer.de/aloma/en

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