

Operator ([eqn0, eqn1, eqn2, ...])

Analysis

Equations lowering

Lower symbolic derivatives to stencil expressions
Constant folding
Index shifting (to account for halo and padding)
Lower SubDimensions and SubDomains

Clustering

Group equations into "Clusters", based on data dependencies
Derive iteration and data spaces
Detect computational properties (e.g., parallelism)

Clusters Optimization

Symbolic (flop-reducing) transformations:
Common sub-expressions elimination
Aliases detection and precomputation
Factorization
Code motion
...

Optimizations for data locality and parallelism:
Fusion
Fission
Blocking

CPU_n

GPU_n

Tree-fication

Turn an ordered list of Clusters into an Abstract Syntax Tree (AST)

AST specialization

Optimized distributed-memory parallelism via MPI
Optimized shared-memory parallelism via OpenMP
SIMD vectorization via OpenMP
Misc optimizations (e.g., denormals_

CPU_n

GPU_n

AST finalization

Loop nest optimization, such as

Symbol declarations and definitions
Data movement (host-device)
Instrumentation for profiling
Header files, globals, macros, ...

CPU_n

GPU_n

JIT-compilation

Synthesis (AST -> file on disk)
Invocation of backend compiler to create a library (".so")