UFMG

Kiriko

A Framework for Evaluating Polyhedral Compilers

Compilers Laboratory

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Kiriko

DCC



github.com/lac-dcc/Kiriko

Kiriko

DCC

- An all-in-one performance collection infrastructure



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- An all-in-one performance collection infrastructure
- Focused on Polyhedral Compilers



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  - Loop Optimizations



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  - Represent loops as geometric objects



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  - Loop Optimizations
  - Represent loops as geometric objects
  - Dependency Analysis



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  - Loop Optimizations
  - Represent loops as geometric objects
  - Dependency Analysis
  - Automated transformations



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- Tools:
  - Pluto
  - LLVM Polly
  - MLIR Affine Dialect
  - Baseline: Clang



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- Linux Perf



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PolyBench

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- Collection of 30 kernel in C

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- Collection of 30 kernel in C
  - Datamining
  - Linear Algebra

PolyBench

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- Collection of 30 kernel in C
  - Datamining
  - Linear Algebra
- Kiriko introduces a PolyBench suite written in MLIR Affine Dialect

Setup

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- Environment Settings

Setup

DCC

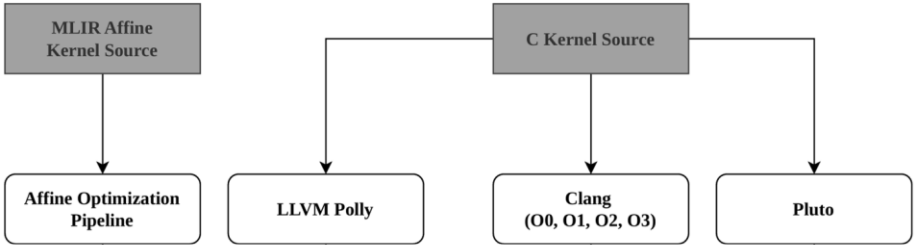
- Environment Settings
  - CLANG_PATH
  - LLC_PATH
  - POLYCC_PATH
  - MLIR_OPT_PATH
  - MLIR_TRANSLATE_PATH
  - SAMPLE_SIZE

Workflow

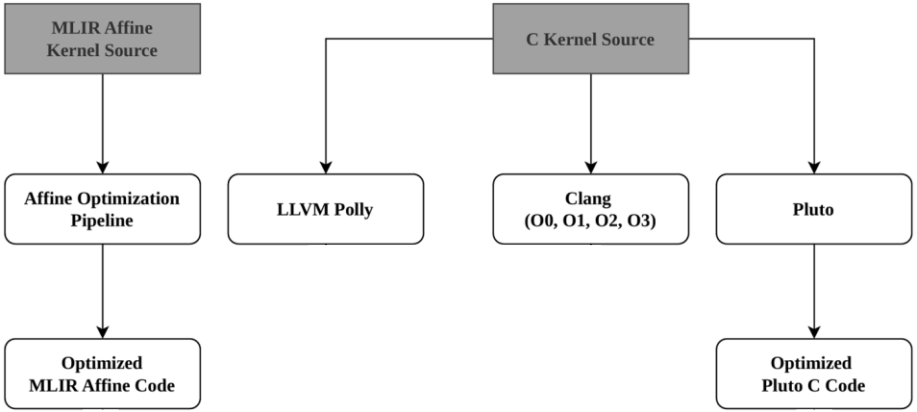
Workflow



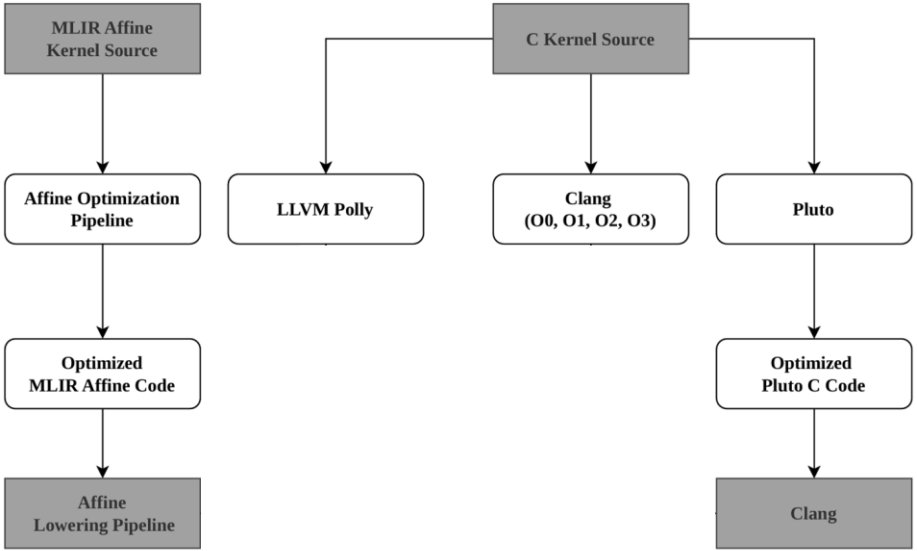
Workflow


MLIR Affine Kernel Source
C Kernel Source
Affine Optimization Pipeline
LLVM Polly
Clang (O0, O1, O2, O3)
Pluto

Workflow


MLIR Affine
Kernel Source
C Kernel Source
Affine Optimization
Pipeline
LLVM Polly
Clang
(O0, O1, O2, O3)
Pluto
Optimized
MLIR Affine Code
Optimized
Pluto C Code

Workflow


MLIR Affine
Kernel Source
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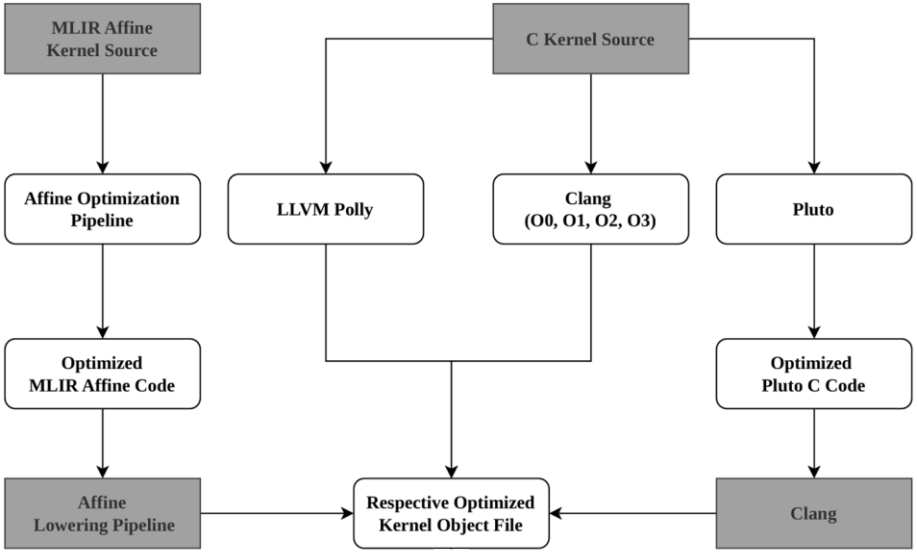
Affine Optimization
Pipeline
LLVM Polly
Clang
(O0, O1, O2, O3)
Pluto
Optimized
MLIR Affine Code
Optimized
Pluto C Code
Affine
Lowering Pipeline
Clang

Workflow


MLIR Affine Kernel Source
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Affine Optimization Pipeline
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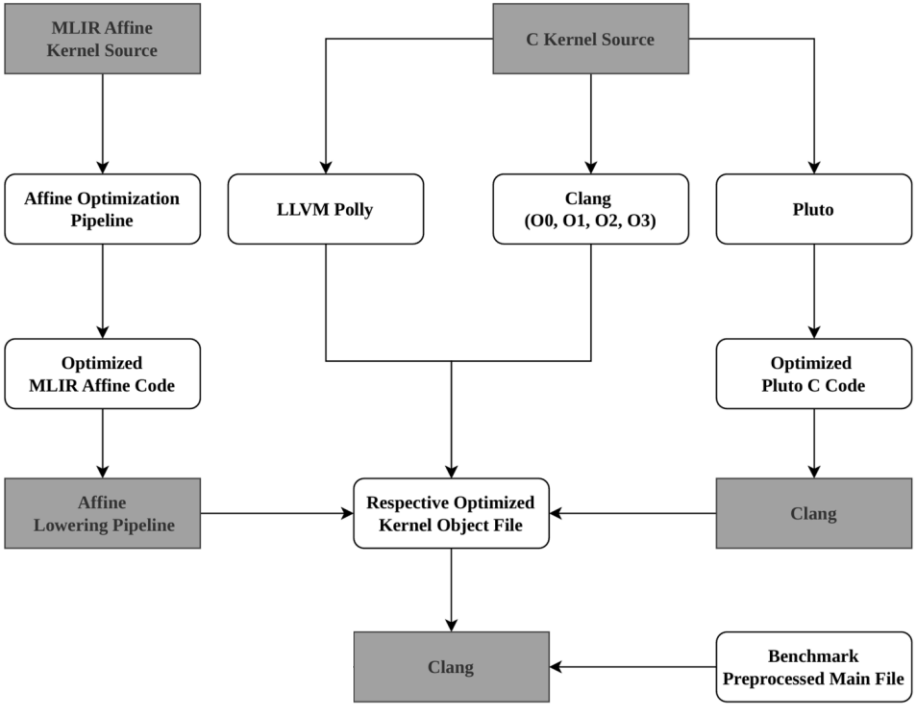
Clang (O0, O1, O2, O3)
Pluto
Optimized MLIR Affine Code
Optimized Pluto C Code
Affine Lowering Pipeline
Respective Optimized Kernel Object File
Clang

Workflow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LLVM Polly
Clang (O0, O1, O2, O3)
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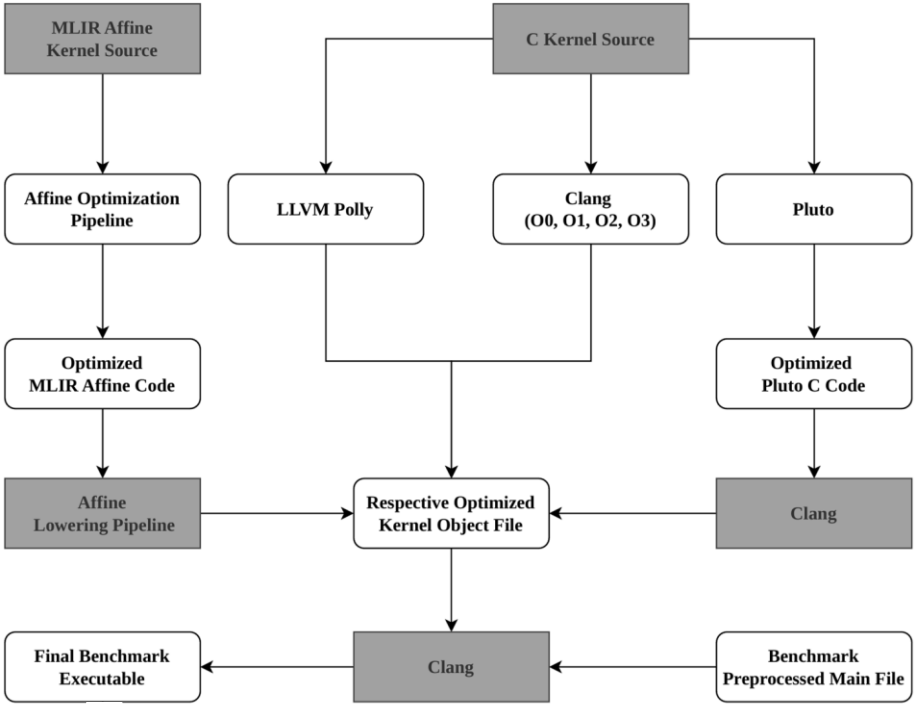
Optimized Pluto C Code
Affine Lowering Pipeline
Respective Optimized Kernel Object File
Clang
Clang
Benchmark Preprocessed Main File

Workflow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Clang (O0, O1, O2, O3)
Pluto
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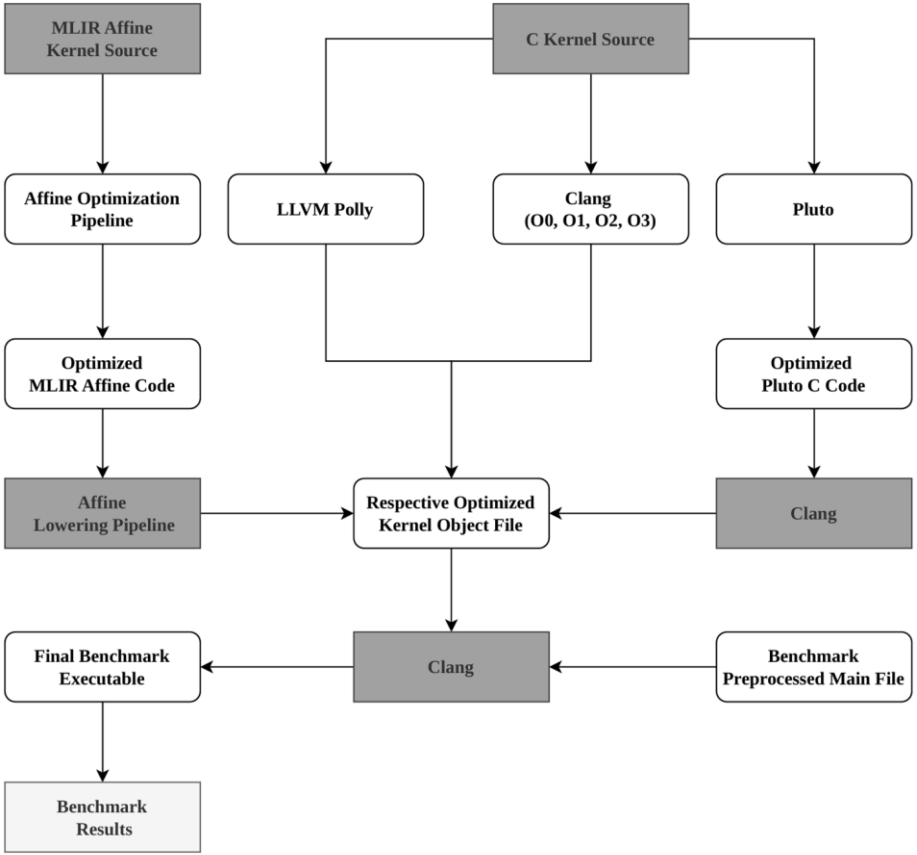
Affine Lowering Pipeline
Respective Optimized Kernel Object File
Clang
Final Benchmark Executable
Clang
Benchmark Preprocessed Main File

Workflow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Clang
Final Benchmark Executable
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Benchmark Preprocessed Main File
Benchmark Results

Perf Metrics

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Perf Metrics

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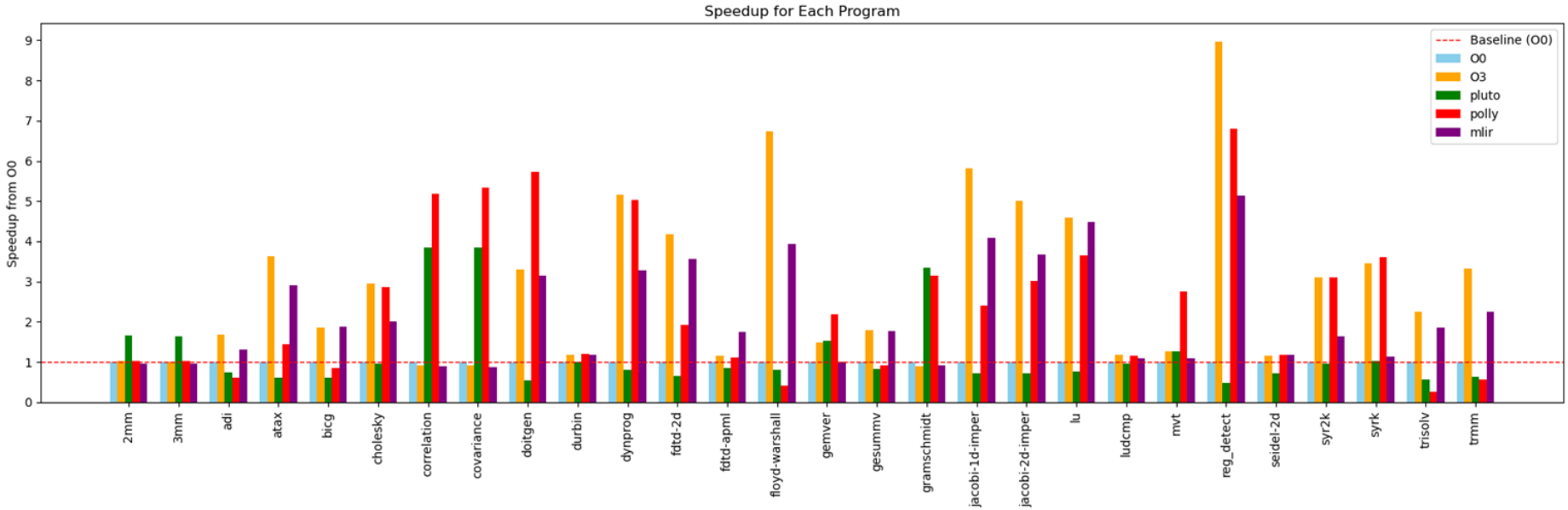
Program	Runtime (s)	CPU Cycles	Instructions	Cache References	Cache Misses
correlation_main_pluto	1.278681	4,497,212,873	13,139,238,326	6,101,380	828,954
covariance_main_pluto	1.549036	4,436,077,379	12,757,970,351	6,644,667	939,567
2mm_main_pluto	8.467904	29,707,093,247	61,769,761,638	24,905,749	1,198,999
3mm_main_pluto	12.702359	44,694,208,756	90,844,029,786	30,815,812	1,417,353
atax_main_pluto	0.170395	918,449,051	1,253,846,204	5,533,454	5,037,068
bicg_main_pluto	0.155605	889,542,611	1,149,779,010	7,553,389	6,689,063
cholesky_main_pluto	0.514379	1,769,998,202	5,402,176,141	2,097,682	938,806
doitgen_main_pluto	2.111096	7,602,320,129	13,448,541,237	9,608,746	1,084,033

Results

Results


Speedup for Each Program
Speedup from O0
Baseline (O0)
O0
O3
pluto
polly
mlir
0
1
2
3
4
5
6
7
8
9
2mm
3mm
adi
atax
bicg
cholesky
correlation
covariance
doitgen
durbin
dynprog
fdtd-2d
fdtd-apml
floyd-warshall
gemver
gesummv
gramschmidt
jacobi-1d-imper
jacobi-2d-imper
lu
ludcmp
mvt
reg_detect
seidel-2d
syr2k
syrk
trisolv
trmm

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