Spot the Difference with LLVM-FLOW :

an open-source interactive visualization tool for comparing IR CFGs

Jinmyoung Lee

ML2

1. Control Flow Graph (CFG)

Control Flow Graph (CFG)

A *Control Flow Graph* is a directed graph that represents the program's control flow, where nodes represent basic blocks, and edges represent the flow of control between those blocks.

Representing LLVM IR as a CFG allows for efficient analysis and optimization of code.

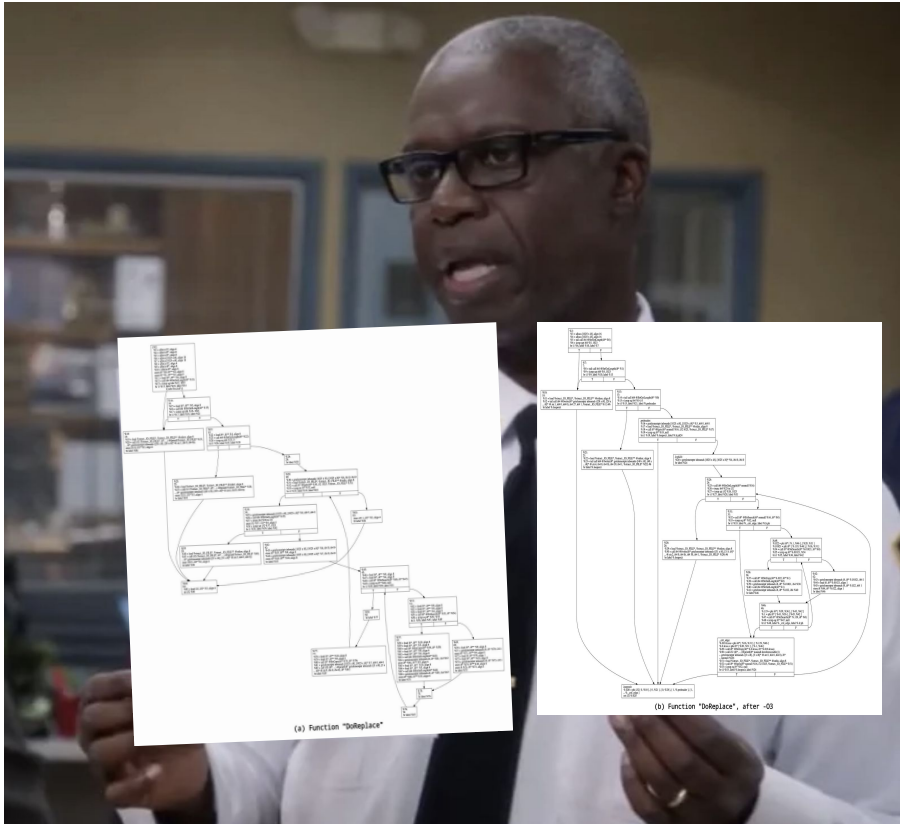
The LLVM optimizer has analysis pass (`-dot-cfg, -view-cfg`) that visualizes the CFG.

https://llvm.org/docs/Passes.html, https://releases.llvm.org/11.0.0/tools/flang/docs/ControlFlowGraph.html

However,

Here are two pictures.
One is CFG before optimization,
the other is after.

Can you tell what has changed?



from ‘Brooklyn Nine-Nine’

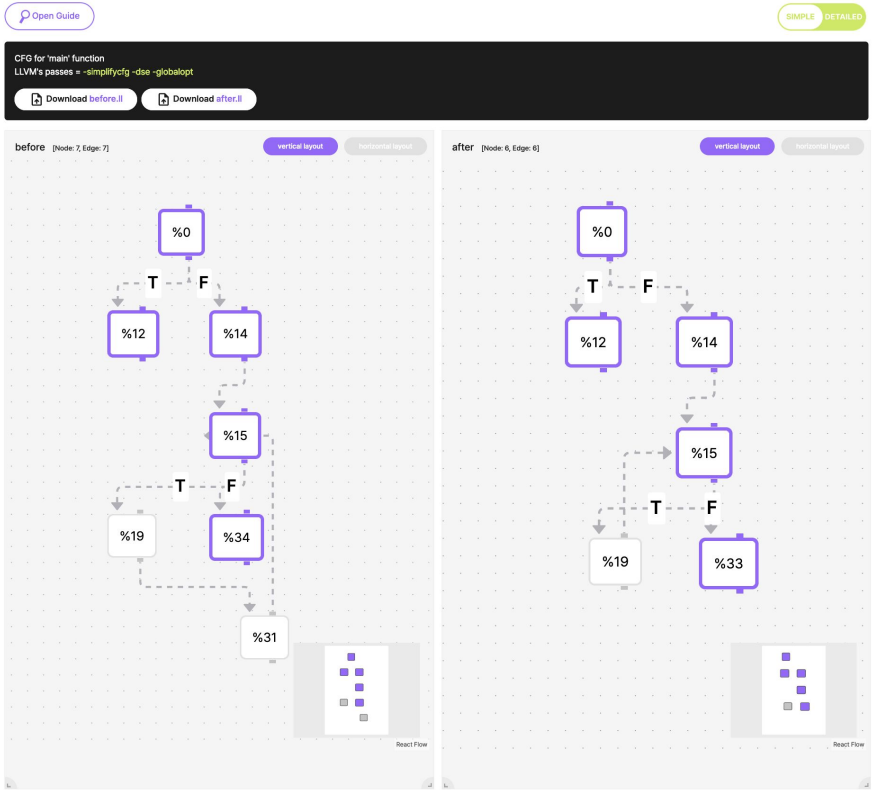
2. LLVM-FLOW

What is LLVM-FLOW ?

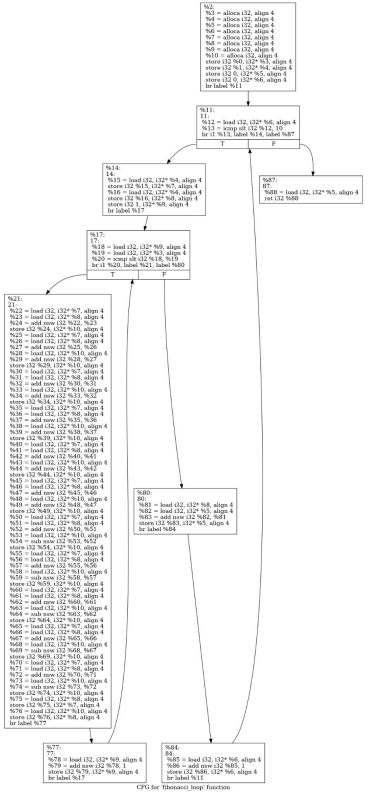
✅ visualization tool for comparing IR CFGs

✅ interactive web-based interface

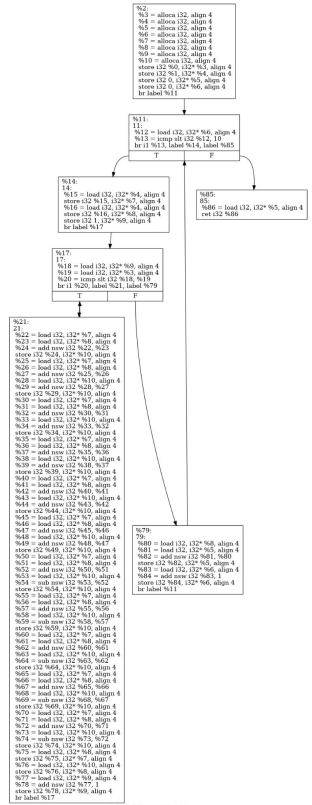
✅ open-source



Example

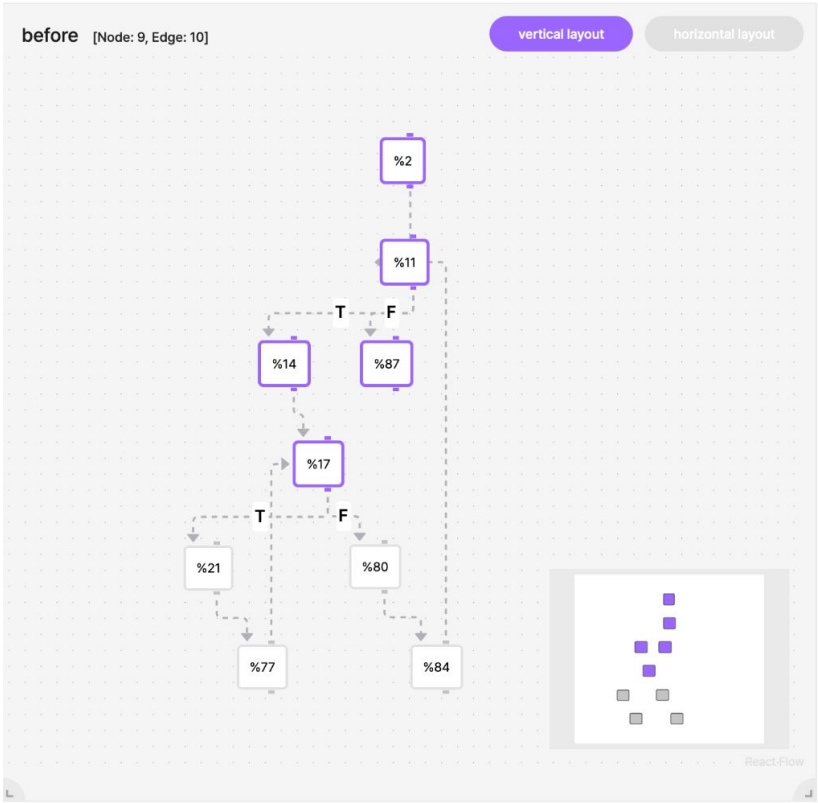


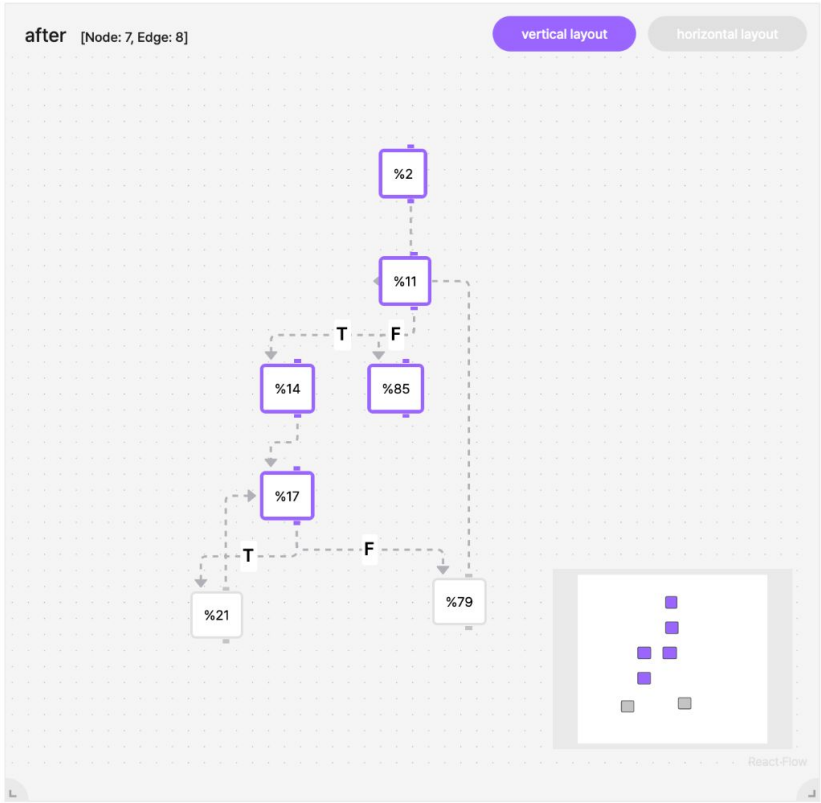
CFG for 'fibonacci_loop' function



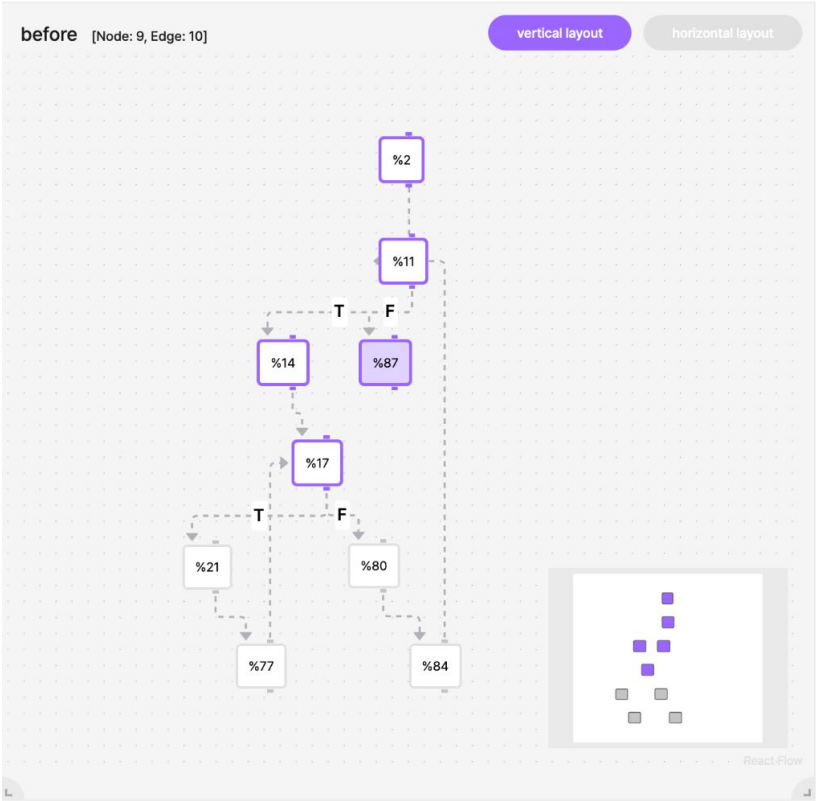
CFG for 'fibonacci_loop' function

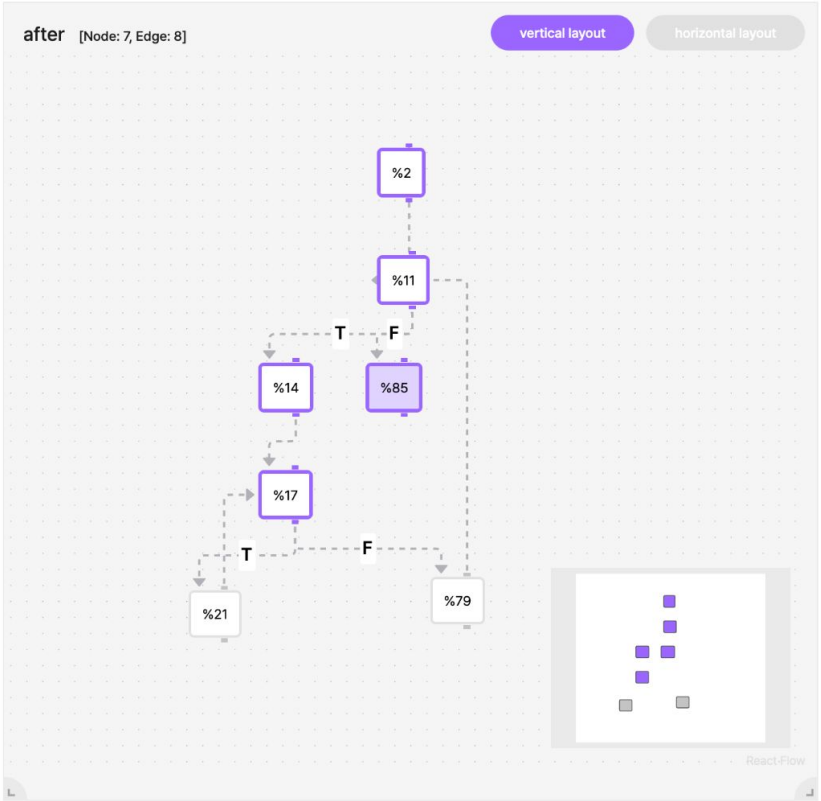
Example


before
[Node: 9, Edge: 10]
vertical layout
horizontal layout
%2
%11
T
F
%14
%87
%17
T
F
%21
%80
%77
%84
React Flow

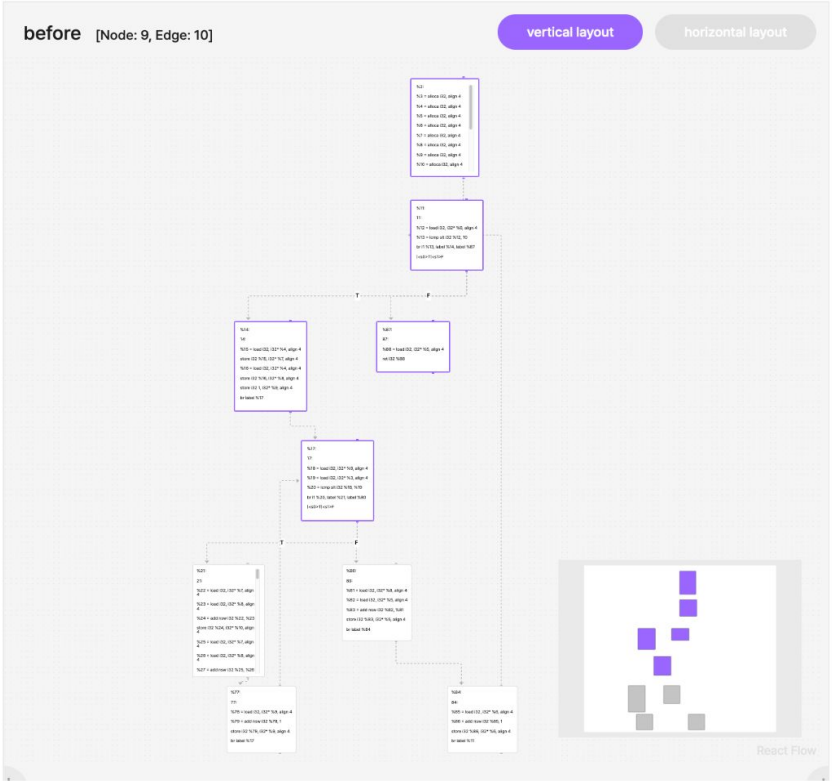

after
[Node: 7, Edge: 8]
vertical layout
horizontal layout
%2
%11
T
F
%14
%85
%17
T
F
%21
%79
React Flow

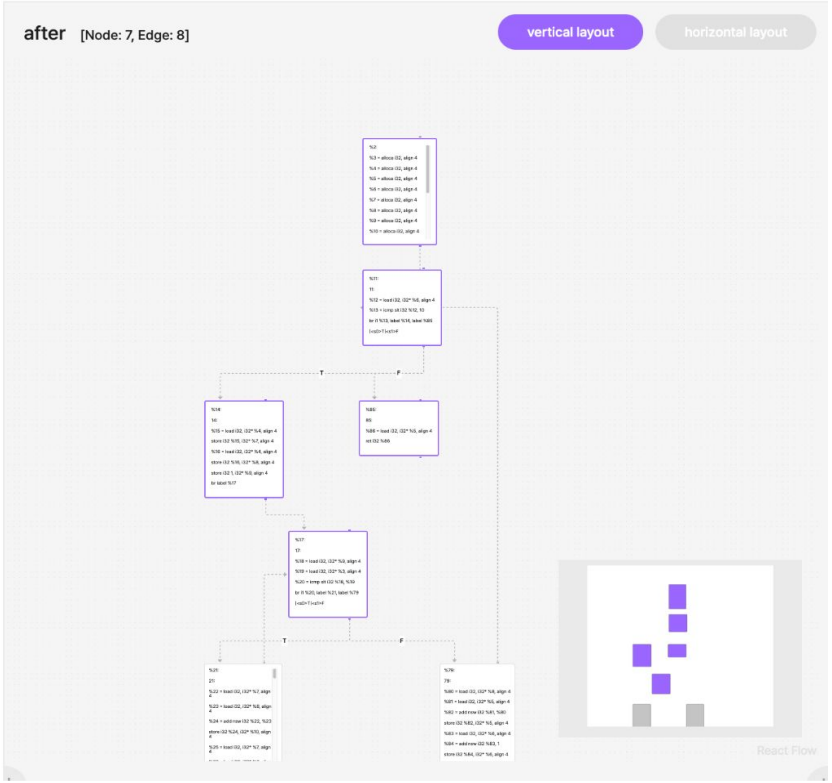
Example


before
[Node: 9, Edge: 10]
vertical layout
horizontal layout
%2
%11
T
F
%14
%87
%17
T
F
%21
%80
%77
%84
React Flow

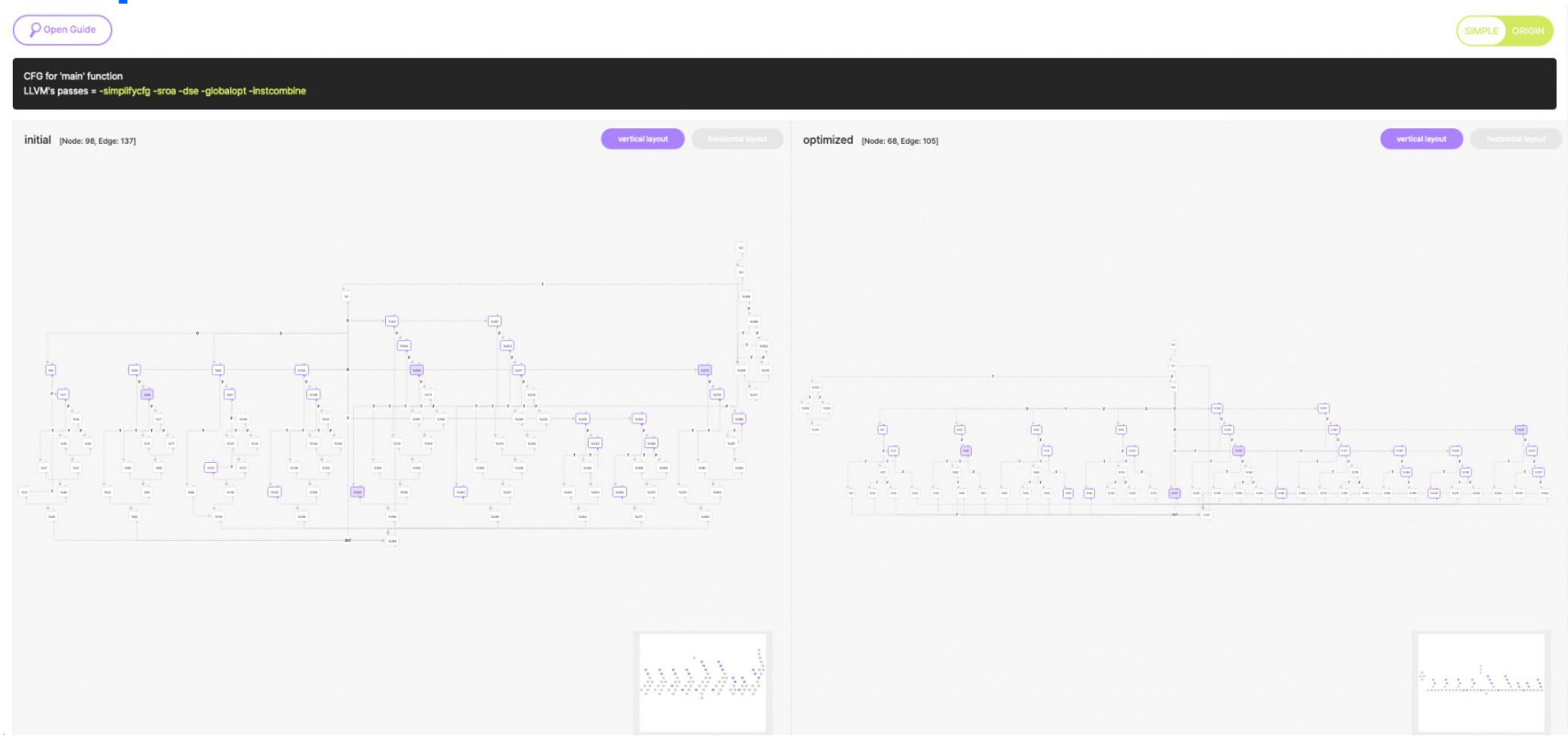

after
[Node: 7, Edge: 8]
vertical layout
horizontal layout
%2
%11
T
F
%14
%85
%17
T
F
%21
%79
React Flow

Example


before [Node: 9, Edge: 10]
vertical layout
horizontal layout
React Flow


after [Node: 7, Edge: 8]
vertical layout
horizontal layout
React Flow

Example

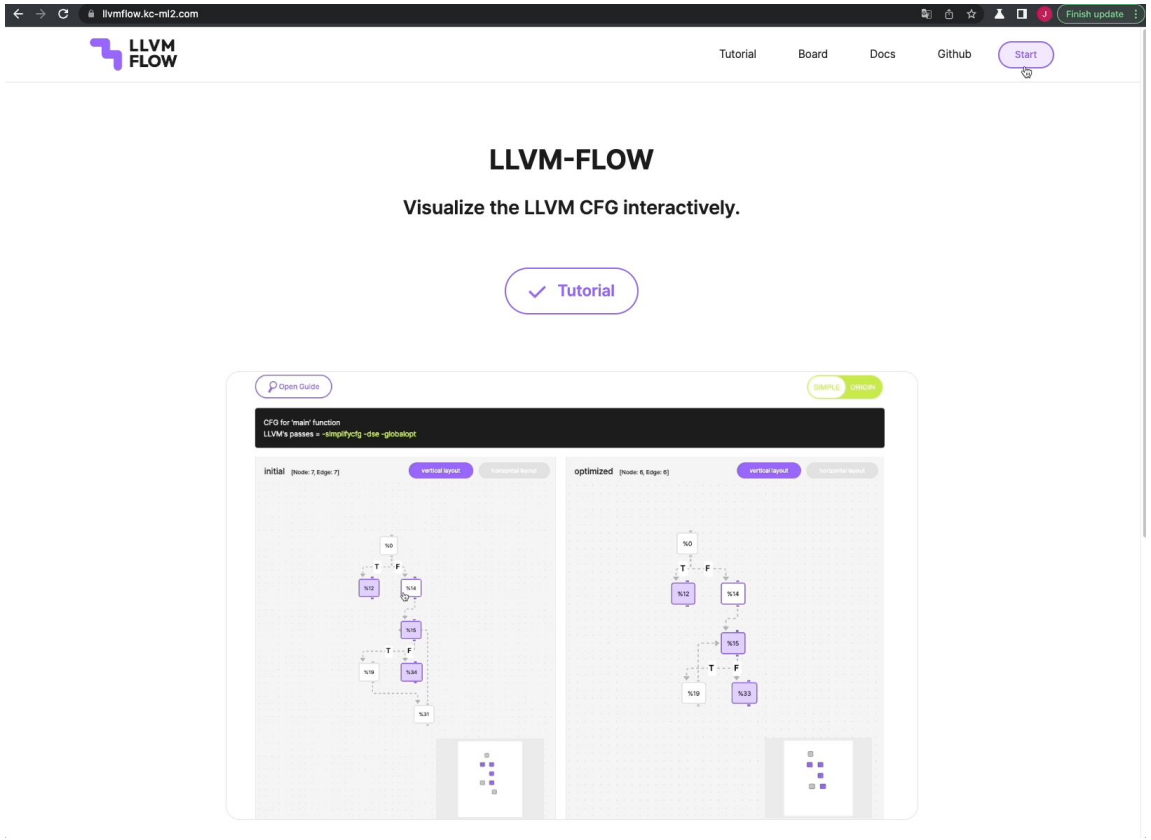

Open Guide
SIMPLE
ORIGIN
CFG for 'main' function
LLVM's passes = -simplifycfg -sroa -dse -globalopt -instcombine
initial [Node: 98, Edge: 137]
vertical layout
horizontal layout
optimized [Node: 68, Edge: 105]
vertical layout
horizontal layout

How to get started ?

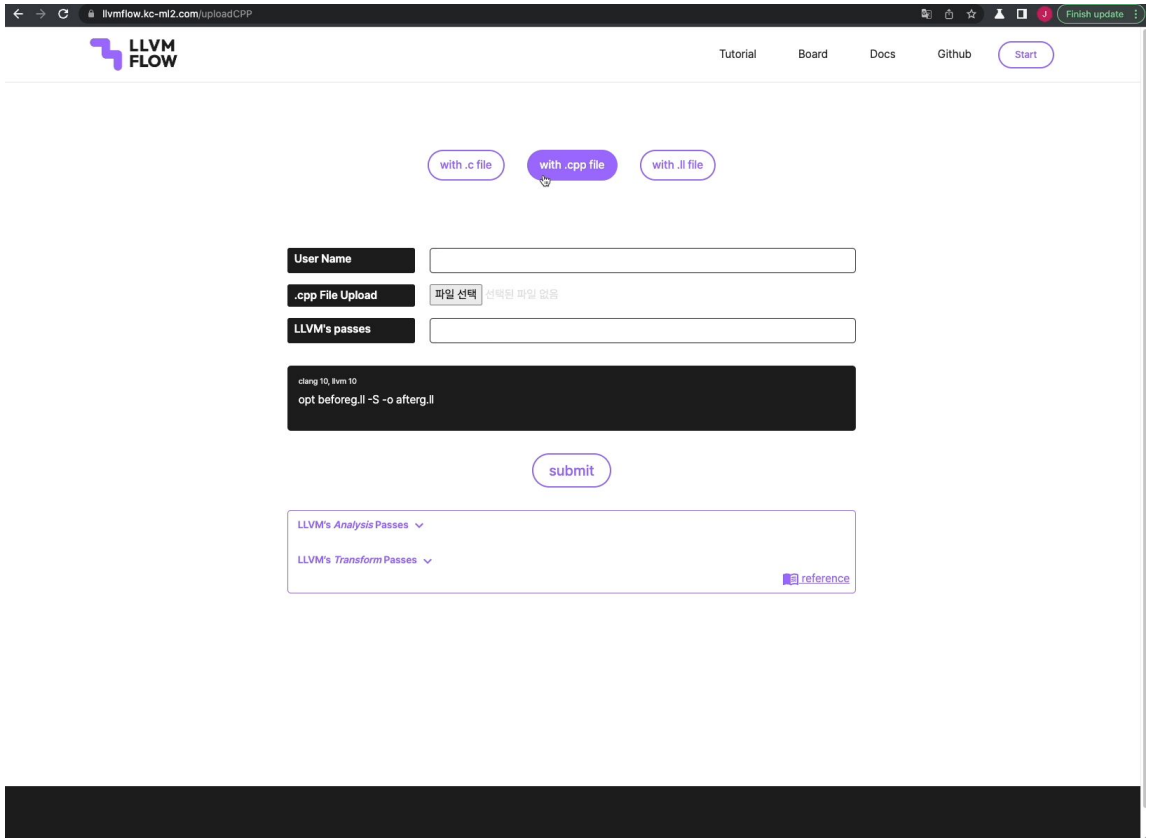
Get started with :

1. **visiting the LLVM-FLOW website (**https://llvmflow.kc-ml2.com/**),**
2. **running it directly on local environment using Docker.**

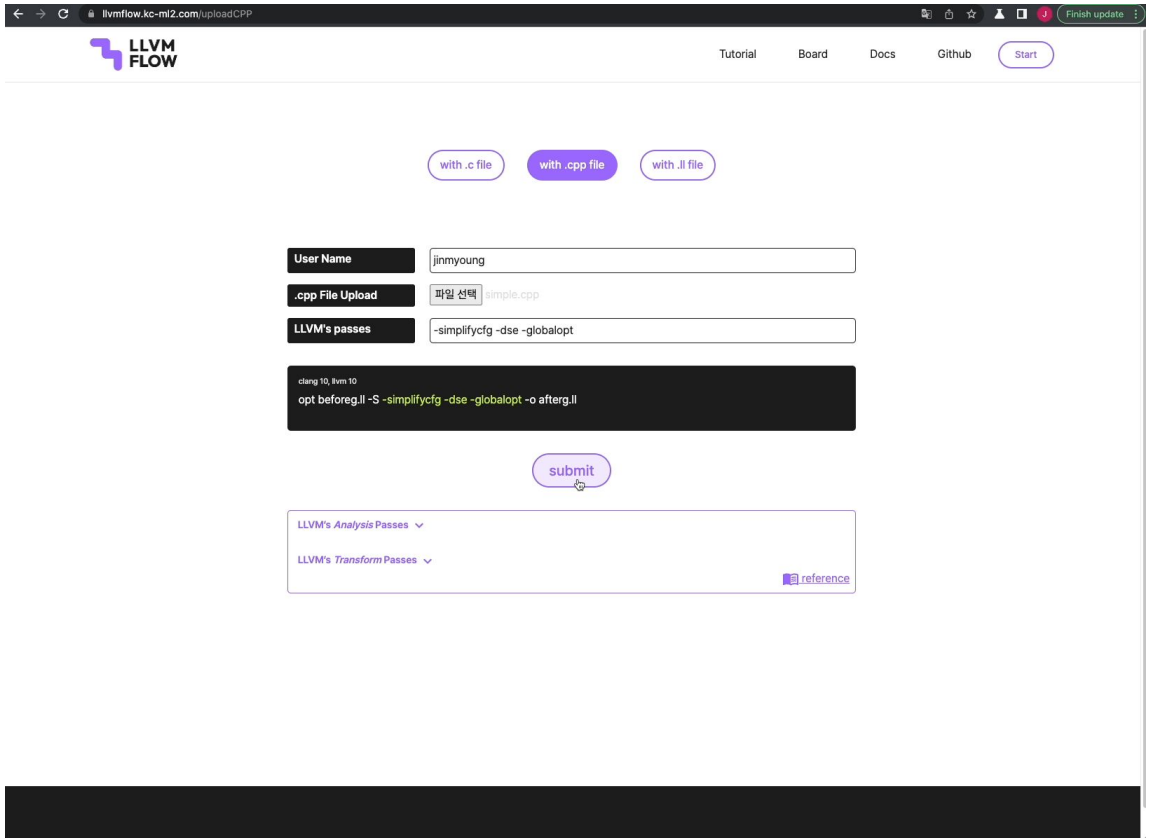
Demo


llvmflow.kc-ml2.com
Finish update
LLVM FLOW
Tutorial
Board
Docs
Github
Start
LLVM-FLOW
Visualize the LLVM CFG interactively.
Tutorial
Open Guide
SIMPLE
ORIGIN
CFG for 'main' function
LLVM's passes = -simplifycfg -dse -globalopt
initial
optimized
vertical layout
horizontal layout

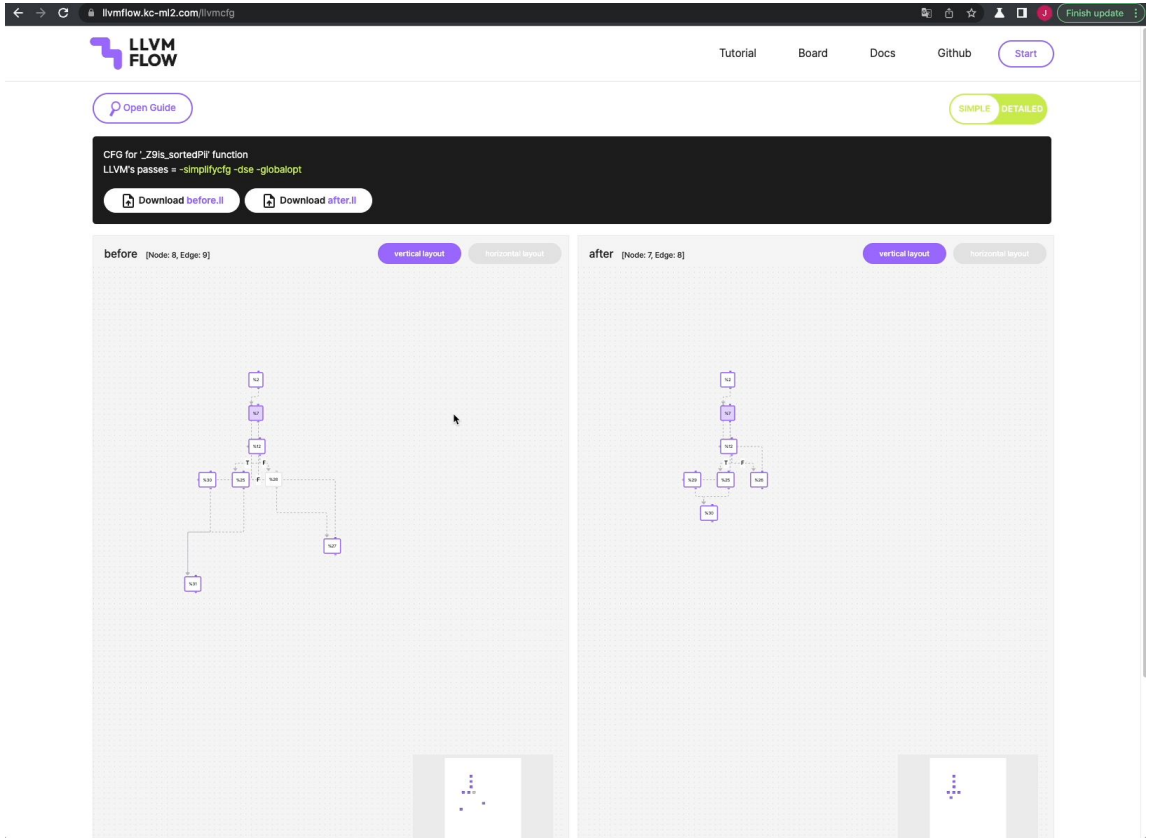
Demo


llvmflow.kc-ml2.com/uploadCPP
Finish update
LLVM FLOW
Tutorial
Board
Docs
Github
Start
with .c file
with .cpp file
with .ll file
User Name
.cpp File Upload
파일 선택
선택된 파일 없음
LLVM's passes
clang 10, llvm 10
opt beforeg.ll -S -o afterg.ll
submit
LLVM's Analysis Passes
LLVM's Transform Passes
reference

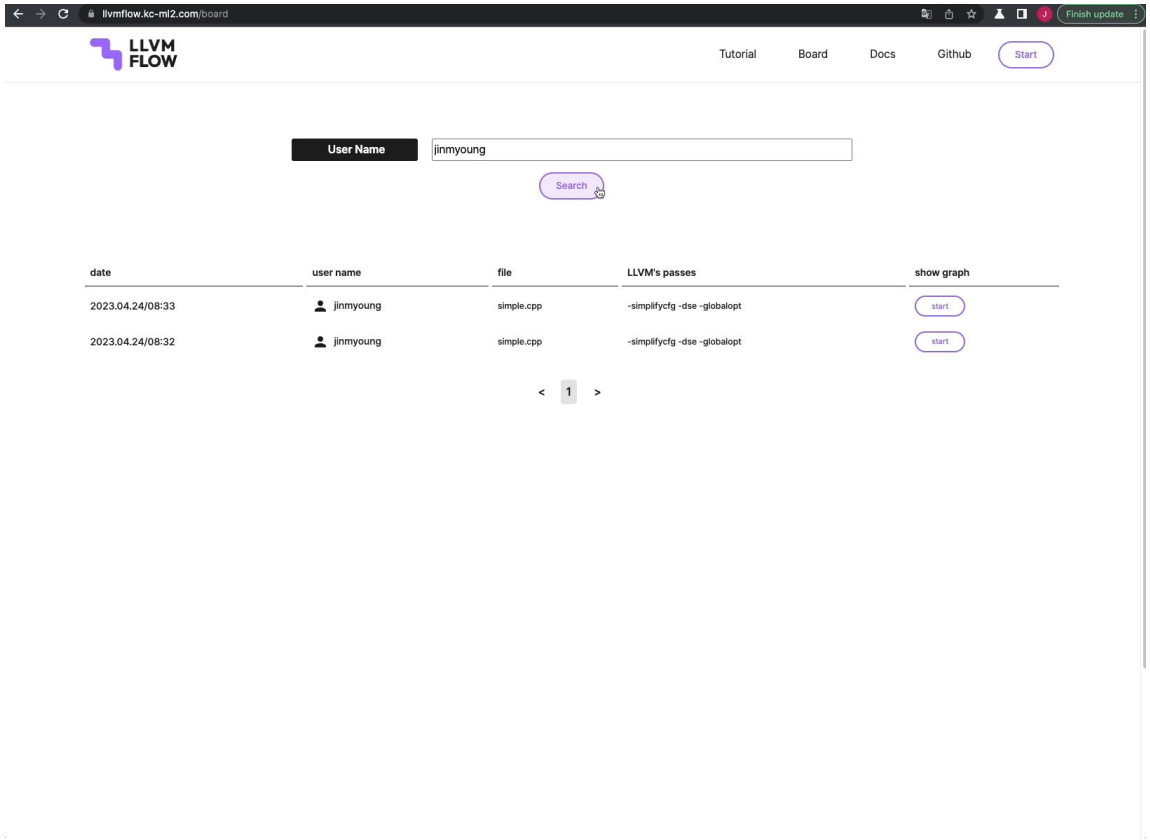
Demo


llvmflow.kc-ml2.com/uploadCPP
Finish update
LLVM FLOW
Tutorial
Board
Docs
Github
Start
with .c file
with .cpp file
with .ll file
User Name
jinmyoung
.cpp File Upload
파일 선택
simple.cpp
LLVM's passes
-simplifycfg -dse -globalopt
clang 10, llvm 10
opt beforeg.ll -S -simplifycfg -dse -globalopt -o afterg.ll
submit
LLVM's Analysis Passes
LLVM's Transform Passes
reference

Demo


llvmflow.kc-ml2.com/llvmcfg
Finish update
LLVM FLOW
Tutorial
Board
Docs
Github
Start
Open Guide
SIMPLE
DETAILED
CFG for '_Z9is_sortedPii' function
LLVM's passes = -simplifycfg -dse -globalopt
Download before.ll
Download after.ll
before
[Node: 8, Edge: 9]
vertical layout
horizontal layout
after
[Node: 7, Edge: 8]
vertical layout
horizontal layout

Demo


llvmflow.kc-ml2.com/board
Finish update
LLVM FLOW
Tutorial
Board
Docs
Github
Start
User Name
jinmyoung
Search
date
user name
file
LLVM's passes
show graph
2023.04.24/08:33
jinmyoung
simple.cpp
-simplifycfg -dse -globalopt
start
2023.04.24/08:32
jinmyoung
simple.cpp
-simplifycfg -dse -globalopt
start
< 1 >

3. Conclusion

Conclusion

LLVM-FLOW is an open-source tool that enables easy comparison of changes in the CFG.

With your feedback and participation, we hope LLVM-FLOW grows into a project that contributes to the LLVM community :)

QR code

llvmflow.kc-ml2.com