

# mcsema

Statically translate X86 binary to LLVM IR

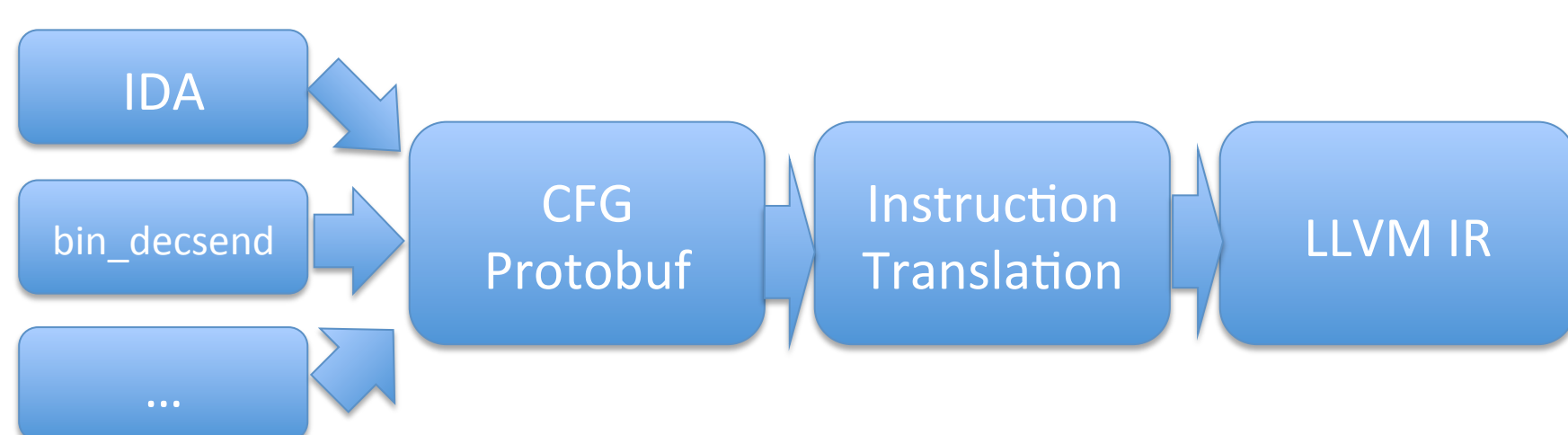
Supports Windows PE and Linux ELF files  
X86 FPU instructions supported  
Built with LLVM 3.2, Protocol Buffers, and Boost

Use LLVM transformations and passes on binary code  
Analyze X86 binary code with LLVM tools such as:  
KLEE, LLBMC, and PAGAI

## Features

- Most X86 instructions
- Windows PE and Linux ELF files
- Integer instructions
- FPU registers
- SSE registers
- Explicit Flags registers
- Callbacks
- External Calls
- Jump Tables
- Data References
- SSE instructions (very few)
- FPU instructions (some)

## Architecture



### Modular Architecture

Designed to translate code from arbitrary sources  
CFG recovery separate from translation  
Integrate with tools such as INSIGHT or jakstab

### Control Flow Graph Recovery

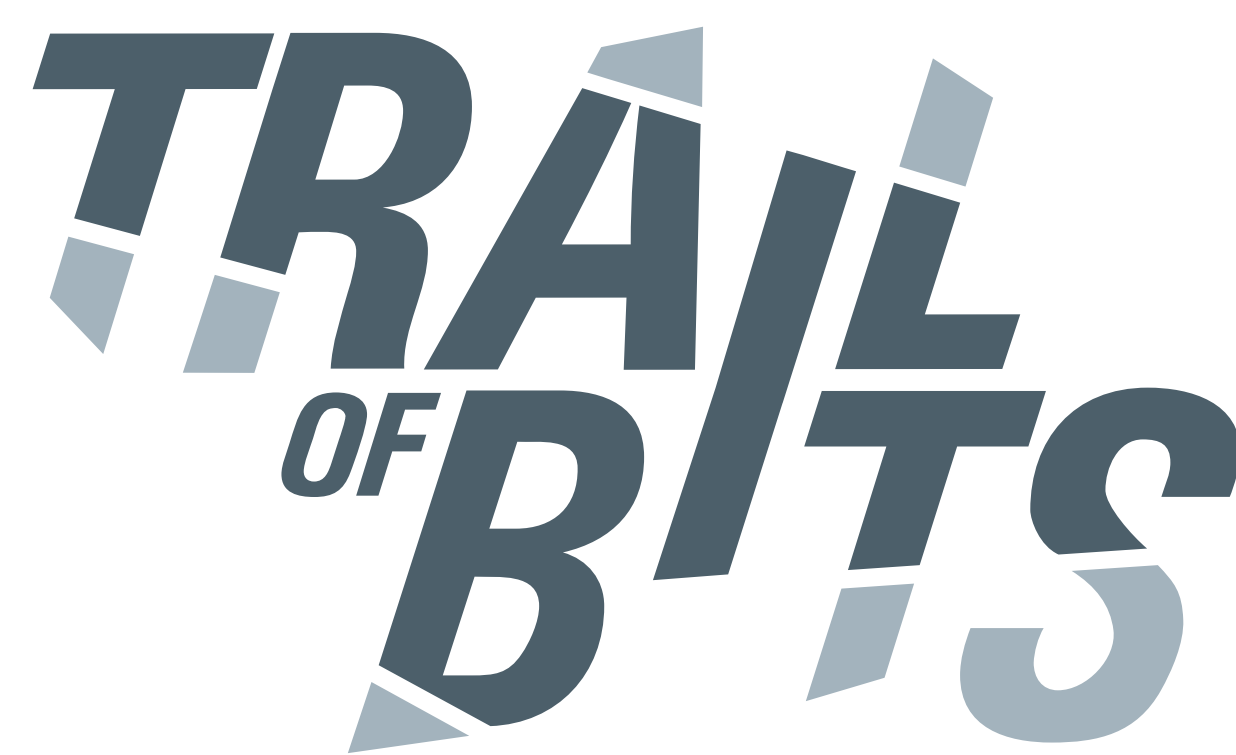
Control flow graphs specified as Google protocol buffers  
Use our CFG recovery tool bin\_descend  
Use existing tools such as IDA Pro to generate CFG

### Translate Instructions

Meticulously implement each X86 instruction as sequence of LLVM IR with the same input and output behavior

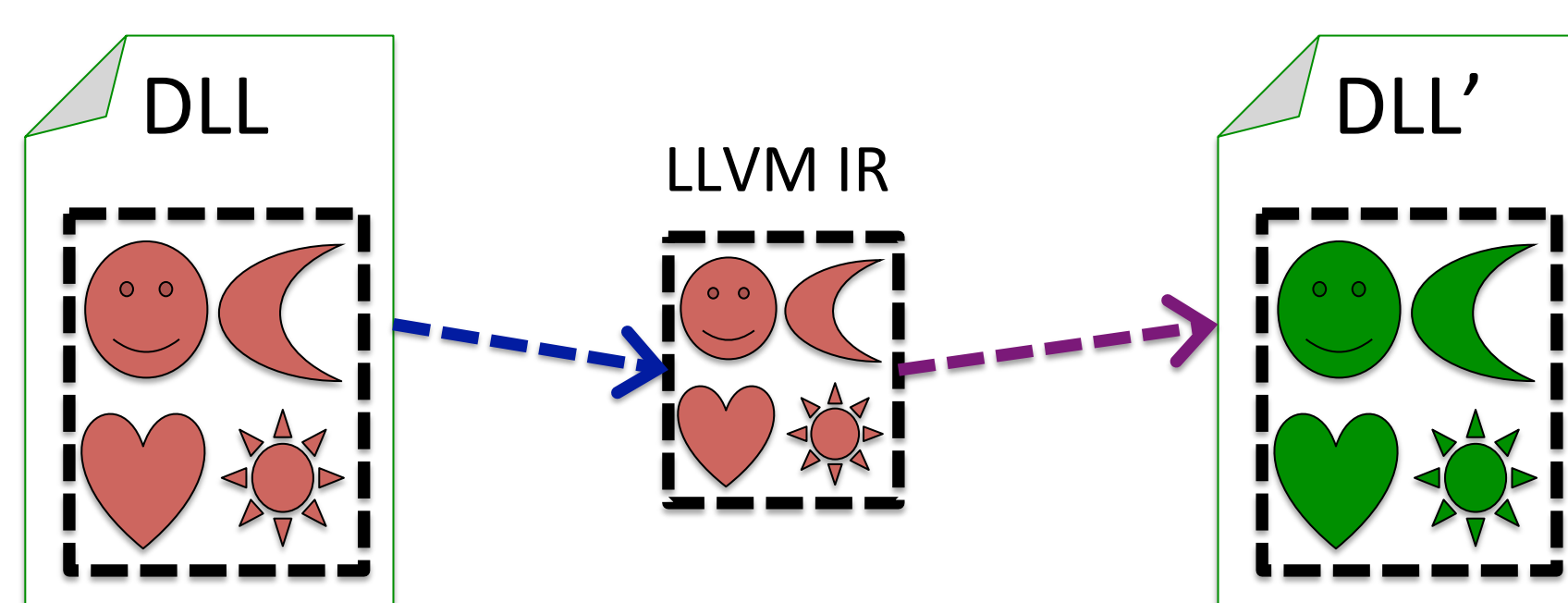
## Future Improvements

- More Linux/ELF support
- More instruction translations
- Stack variable recovery
- Exceptions support
- Privileged instructions
- More optimizations
- More tests
- Update LLVM



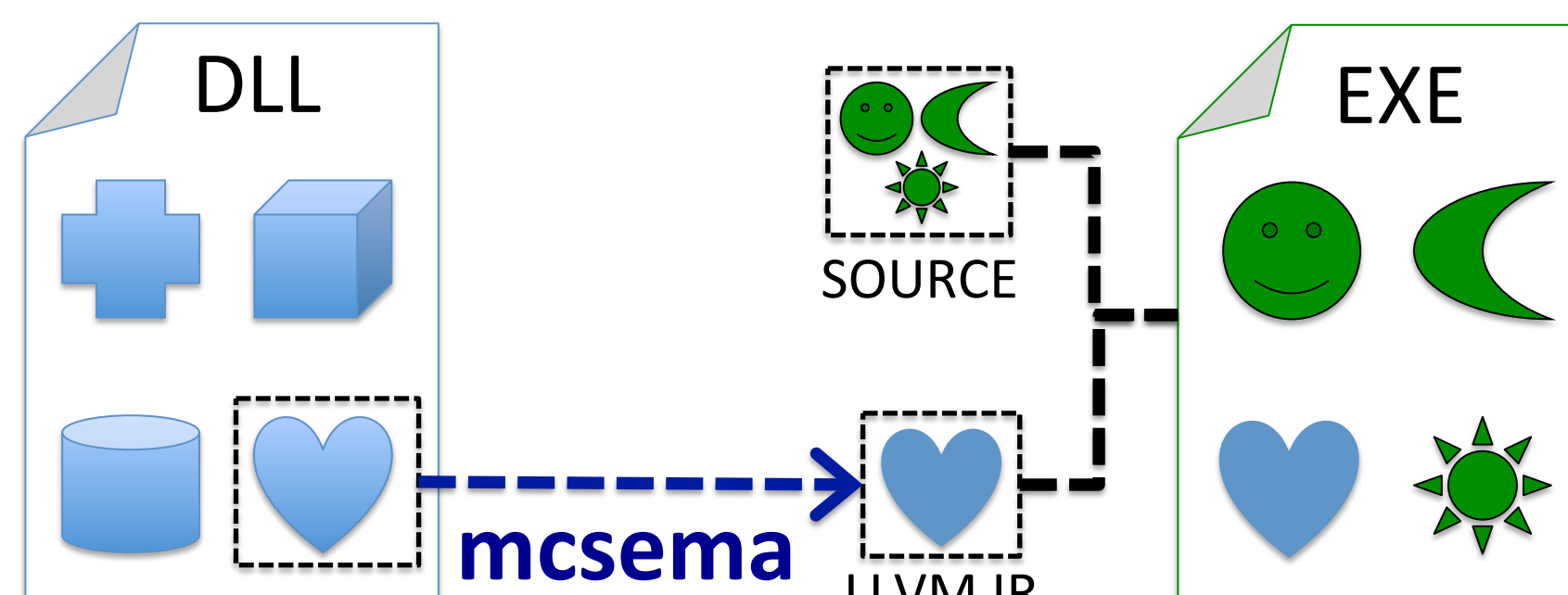
Source and documentation at [github.com/trailofbits/mcsema](https://github.com/trailofbits/mcsema)

## Re-Emit Translated X86



Use LLVM optimizations, obfuscation, and security passes  
Many "source-only" LLVM tools now work on binary code  
Tested Windows Apps running recompiled kernel32.dll

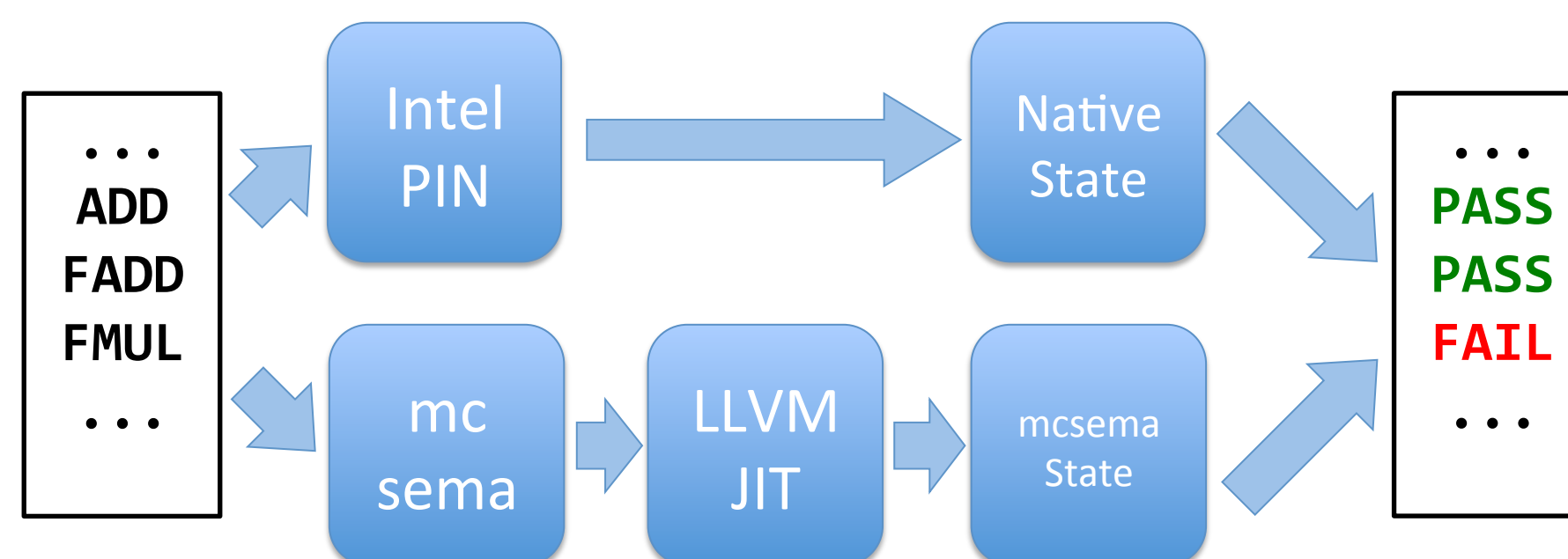
## Per-Function Translation



Translate just the functions you want and their dependencies  
Reuse specific functions from a library

Calling convention agnostic  
Saved register state between function boundaries

## Unit Tests



Instruction level comparison of translated instructions vs native execution