SIMULATE & DUPLICATE

or

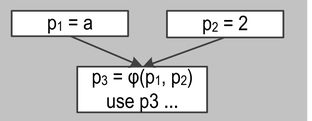
"Simulation-based Code Duplication for Enhancing Compiler Optimizations"

David Leopoldseder
david.leopoldseder@jku.at

JOHANNES KEPLER UNIVERSITY LINZ

Problem

⇒ Control-flow **prohibits** many optimizations



Solution: Code Duplication

⇒ **Copy** merge block into **predecessors**

⇒ **Eliminate** merges **=>** Increase **code size**

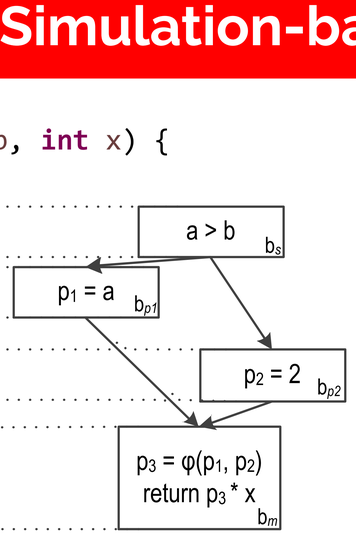
Cost/Benefit Analysis

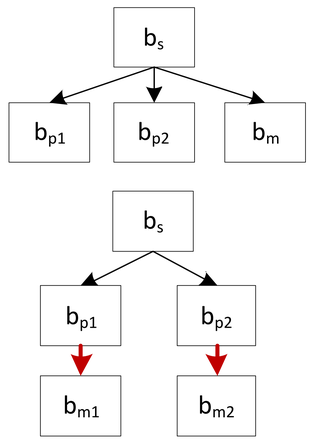
⇒ Find **opportunities prior** to duplication

⇒ Duplicate as **little as possible**

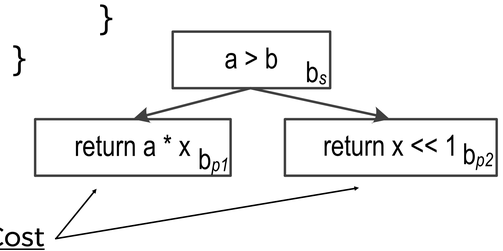
Approach: Simulation-based Code Duplication

```
int f(int a, int b, int x) {
  int p;
  if (a > b) {
    p = a;
  } else {
    p = 2;
  }
  return p * x;
}
```






```
int f(int a, int b, int x) {
    if (a > b) {
        return a * x;
    } else {
        return x << 1;
    }
}
```

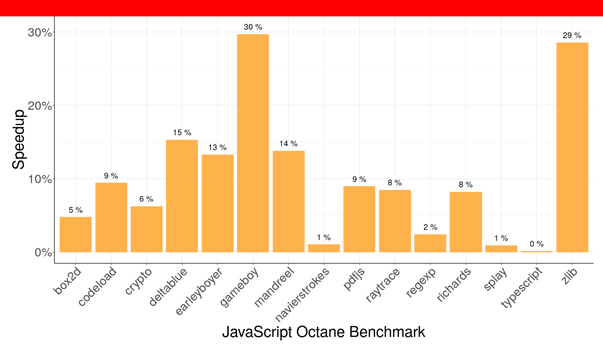


1. **Simulate** Duplication
2. Find Optimization **Opportunities** & **Trade-Off**
   => **Quantify** Opportunities
   => **Cost / Benefit Analysis:** Code Size vs Peak
3. Duplicate & **Optimize**

Why simulate ?

=> No backtracking
=> Make compile-time overhead feasible
=> No cleanup necessary

Performance



Try it out now !

graalvm.github.io