What are Performance Bugs?
- Software defects
- Heavy performance impact
- Simple patches
- Performance bugs inevitably escape into deployed software

What are Diagnosis Tools?
- Tools
- Fault localization
- Give out fix suggestions
- In-house diagnosis tools
- On-line diagnosis tools
- Little support for diagnosing perf. bugs

Characteristics Study
- Study 65 user perceivable performance bugs
- From Apache, Chrome, Mozilla, MySQL, GCC

MRI Design And Implementation

How to get not-taken events from LBR sampling reports?

Branch Collection
Overview
- Helpful for branch related bugs
- Helpful for loop related bugs
- Pin for MRI (in-house diagnosis)
- LBR for oMRI (on-line diagnosis)

Statistical Models
Overview
- Look for buggy branch and loops
- CBI [1] model for branches
- Delta-LDA [2] for loops

Post-mortem Analysis
Overview
- 5 checkers for loop-related bugs
- Static information from LLVM
- Dynamic information from Pin or LBR

What Caused Performance Loss
- Inefficient Loop
  - Other
  - Workless Optional Update Loop
  - Workless Search Loop
- Inefficient Loops
  - Cross-loop Redundant
  - Workless Search Loop
  - Workless Optional Update Loop

What Caused Inefficient Loops
- Other
- Semantic Workless
- Workless-Optional Update Loop
- Workless Search Loop
- Semantic Workless
- Workless Search Loop
- Workless Optional Update Loop
- Workless Search Loop

LBR Sample:
Condition 2: working ratio is too low
Condition 1: loop type is select loop
Condition 2: iteration number is large

Delta-LDA
- Evolve from LDA for debugging
  - A branch ranked high by Delta-LDA
  - More likely to appear in bad runs
  - More frequent to appear in bad runs
  - Cluster branches by innermost loops
  - Utilize Delta-LDA to look for hot loops

Evaluation
- We evaluate MRI on 17 bugs
  - 15 C++ bugs and 2 java bugs
  - 7 branch-related and 12 loop-related
  - 2 bugs have false positives
  - 1.8% - 9.0% for oMRI

References: