Profile Caching for the Java Virtual Machine

Marcel Mohler, ETH Zurich

Bachelor Thesis

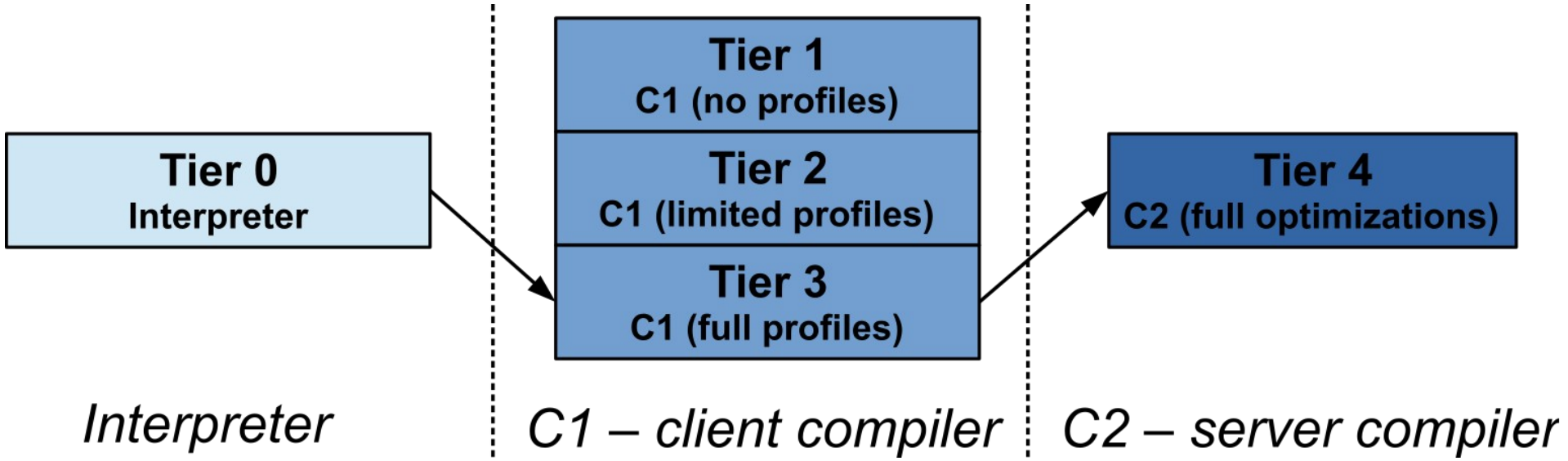
Supervisors: Zoltan Majo, Oracle
Tobias Hartmann, Oracle

Prof. Thomas Gross, Laboratory for Software Technology

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

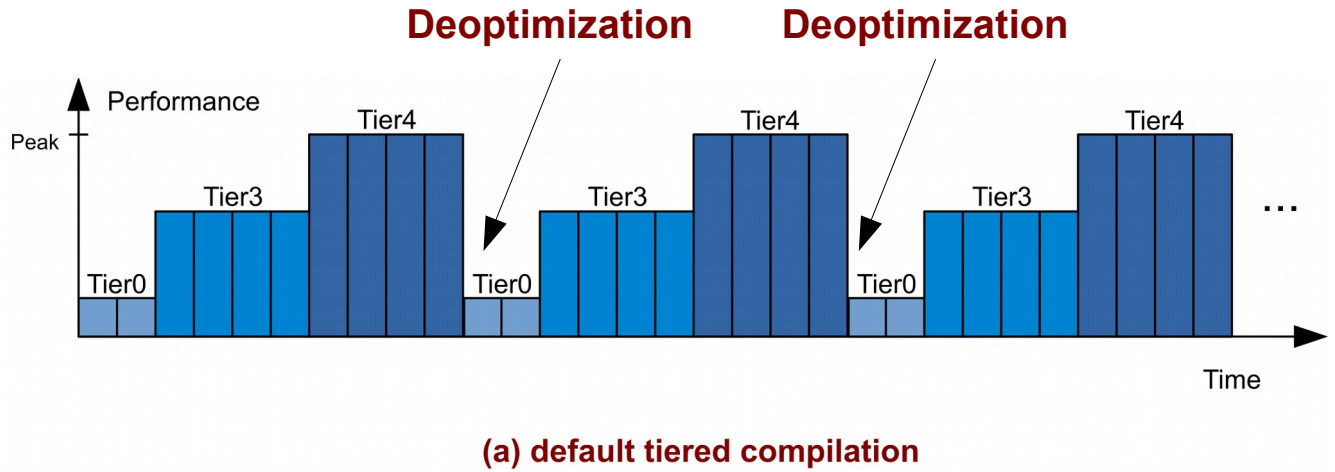
LST
Laboratory for Software Technology

Hotspot™: Tiered Compilation



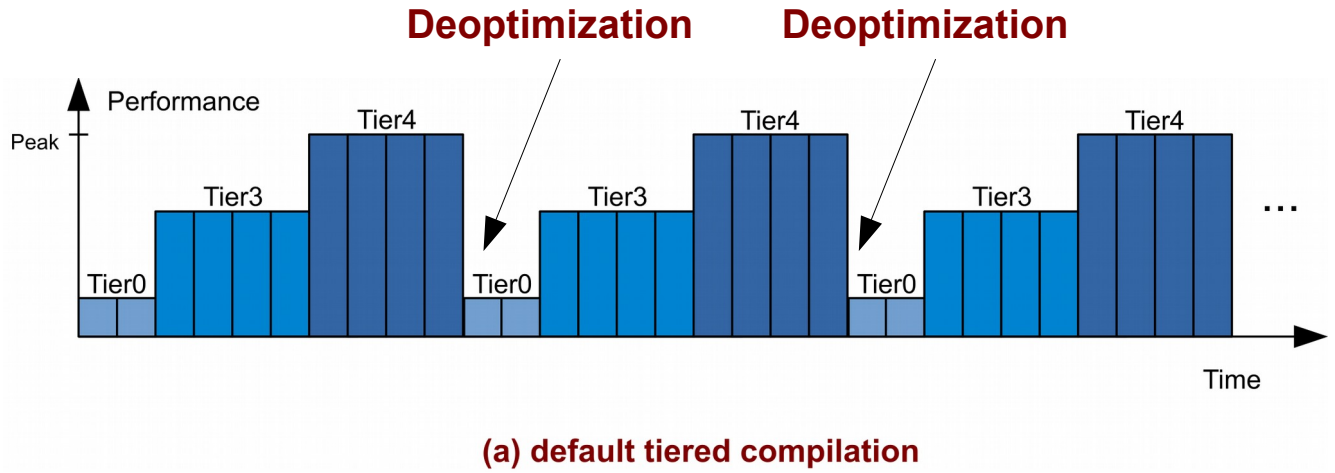
- JVM gathers profiles
- Uses these profiles for code optimizations

Problem

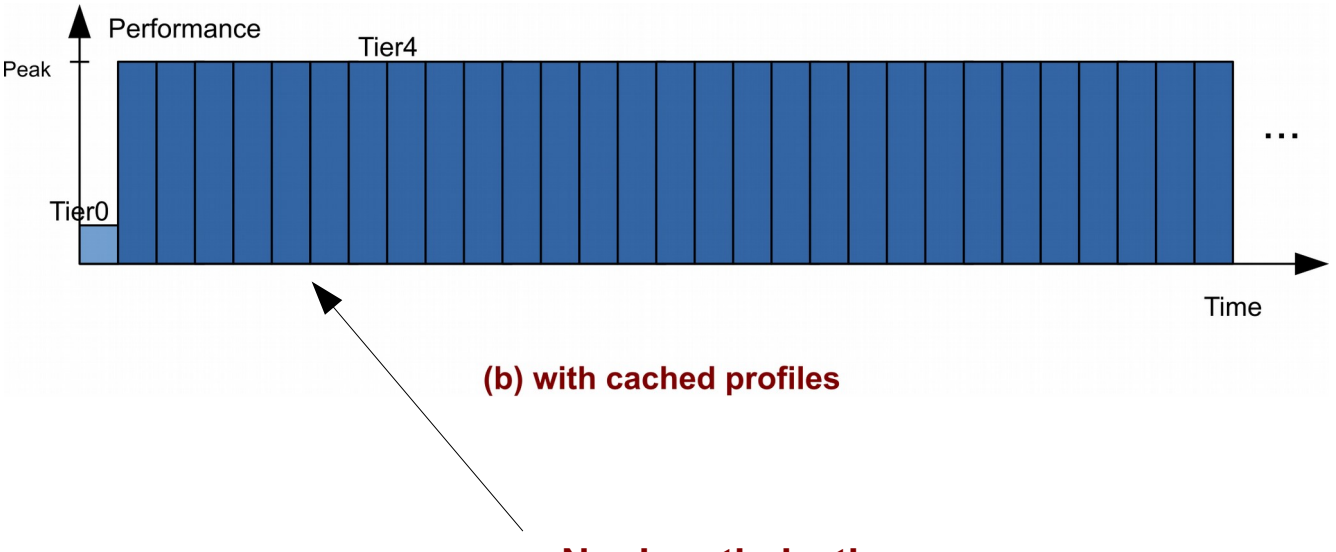


(a) default tiered compilation

Idea



(a) default tiered compilation



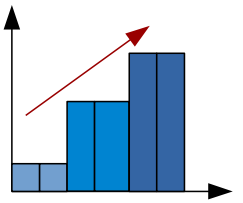
(b) with cached profiles

Goals

Decrease performance fluctuations

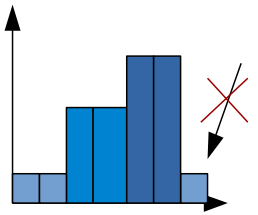
- Faster method performance warmup

  → reach peak performance quicker



- Less deoptimizations

  → stay on peak performance



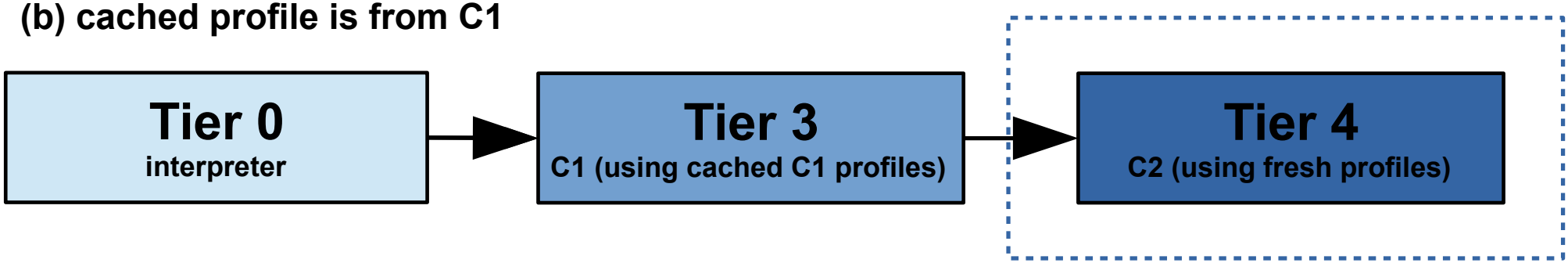
Design: dump profiles

- 1 run of JVM where profiles get dumped to disk
- Store method metadata, profiles and compile information of C3 & C4 compilations

Design: use profiles

(a) cached profile is from C2:

(b) cached profile is from C1



Implementation

- 1846 lines of code
- 24 files affected
- 2 new classes
  - ciCacheProfiles
  - ciCacheProfilesBroker

Evaluation

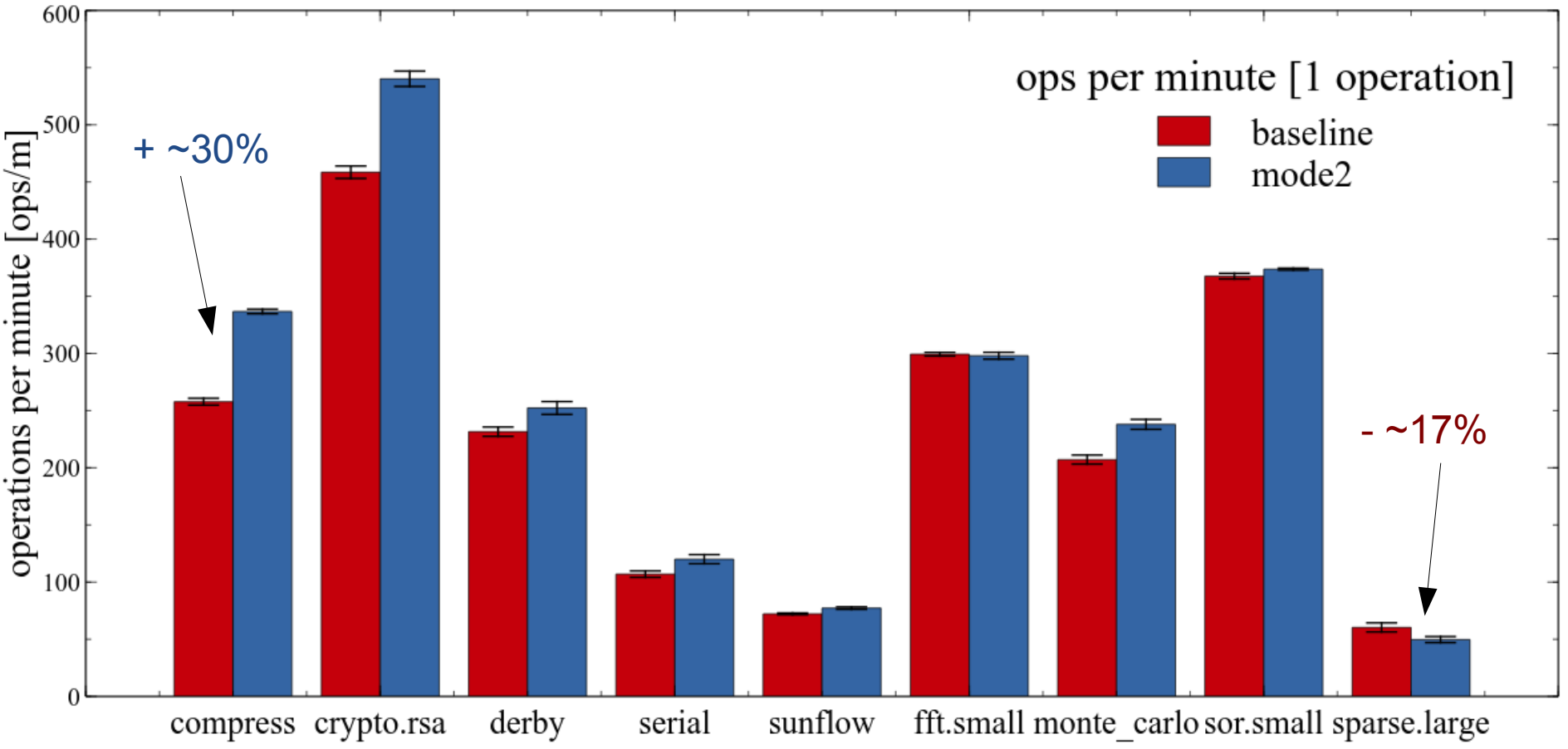
- ETH Data Center Observatory
- Focus on warmup, not overall performance
- 2 benchmark suites
  - SPECjvm 2008

    17 individual benchmarks
  - Google Octane (using Nashorn)

    16 individual benchmarks

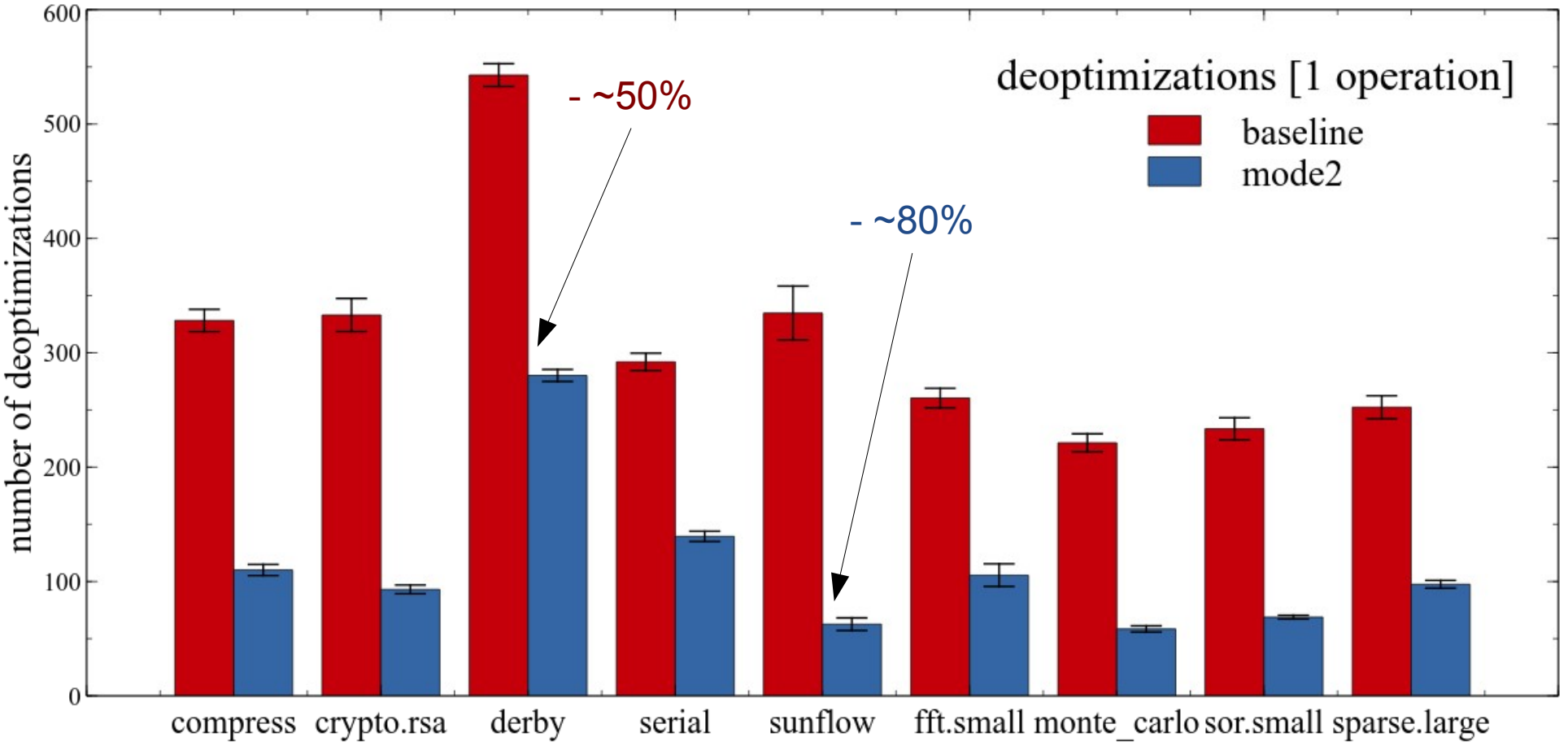
Performance evaluation

- Performance (higher is better)



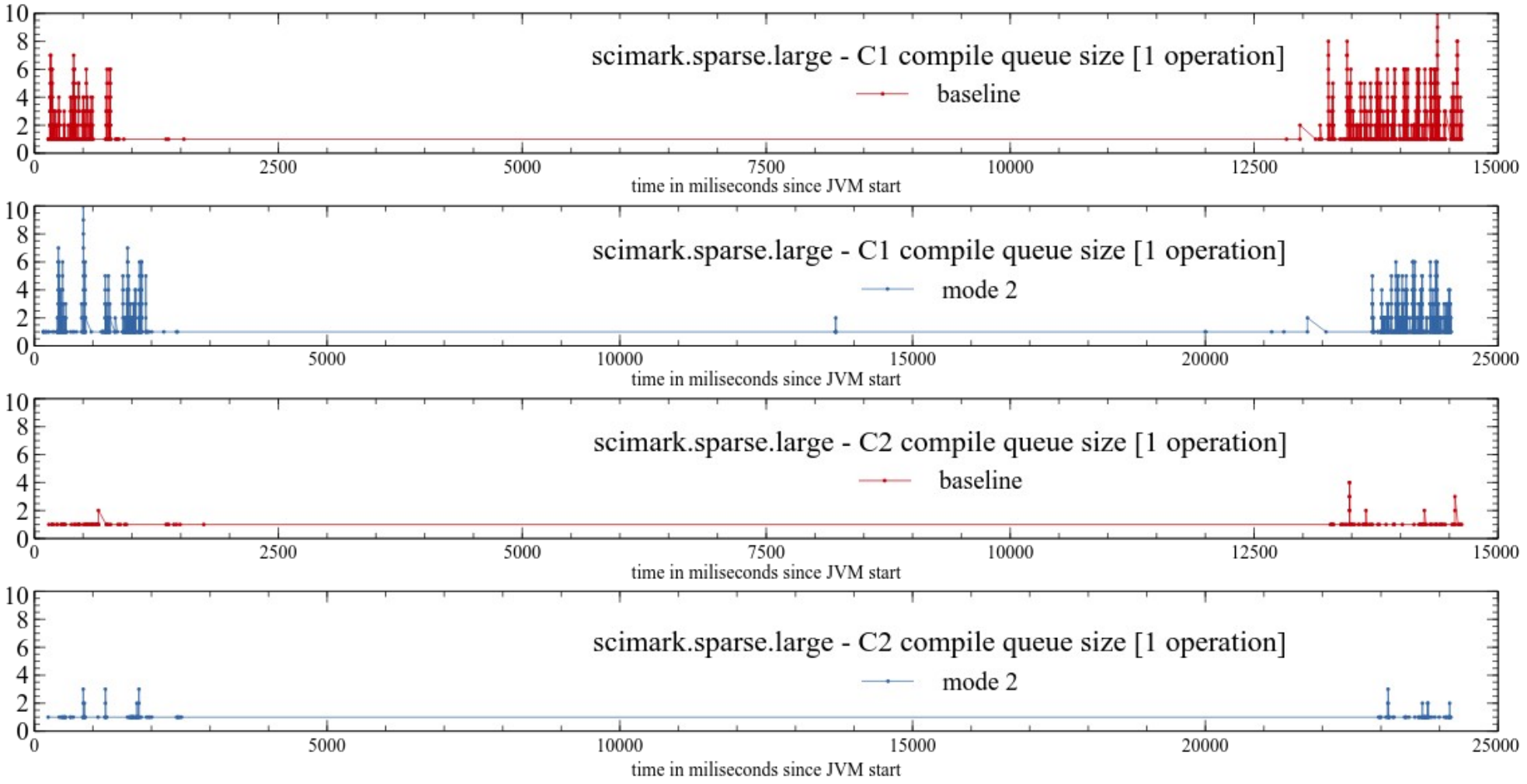
Performance evaluation

- Deoptimizations (lower is better)



Performance evaluation

- Compilation queue



Other benchmark results

- Disabling intrinsics does not influence performance
- Benefit mainly from C2 compilations. Disabling C1 profiles does not affect performance significantly
- Around 70% of the compilations use profiles

Other approaches

- Presented: Mode2

- Mode 0: skip C1 & lower compilation thresholds
- Mode 1: skip C1 & keep original compilation thresholds

Conclusion

- Complex system
- Reasons for performance influence difficult to measure
- Cached profiles *can* greatly improve warmup performance if used properly
- System requires manual configuration

Thank you for listening