Trace Based Switching For A Tightly Coupled Heterogeneous Core
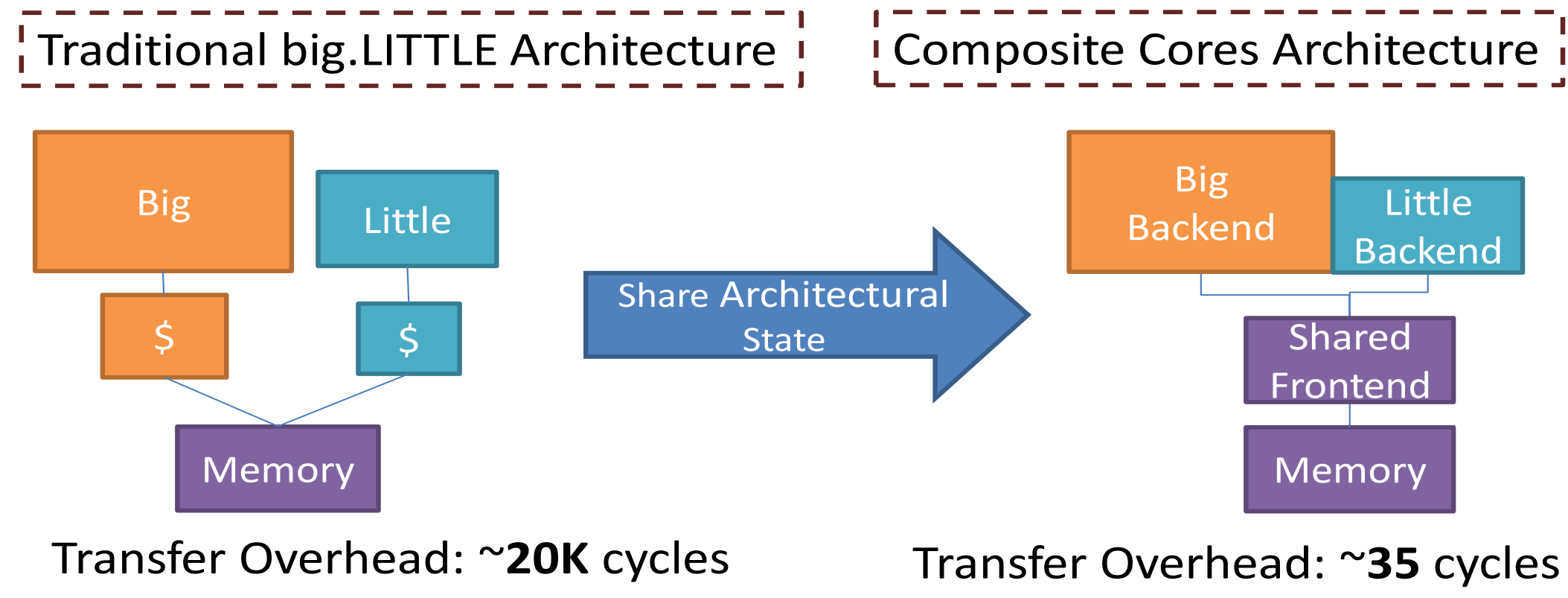
Shruti Padmanabha, Andrew Lukefahr, Reetuparna Das, Scott Mahlke
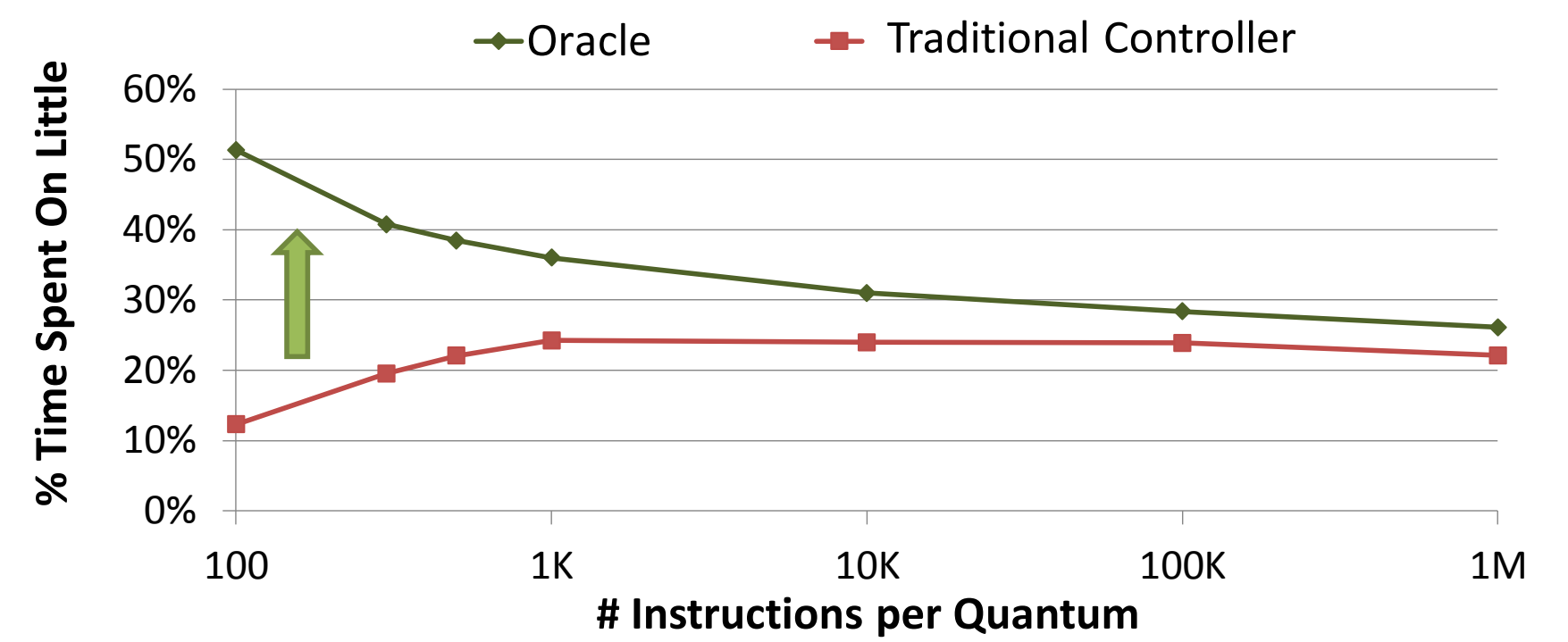
University of Michigan
Electrical Engineering and Computer Science

CCC compilers creating custom processors

Fine-grained Heterogeneity

Traditional big.LITTLE Architecture

Composite Cores Architecture

Transfer Overhead: ~**20K** cycles

Transfer Overhead: ~**35** cycles

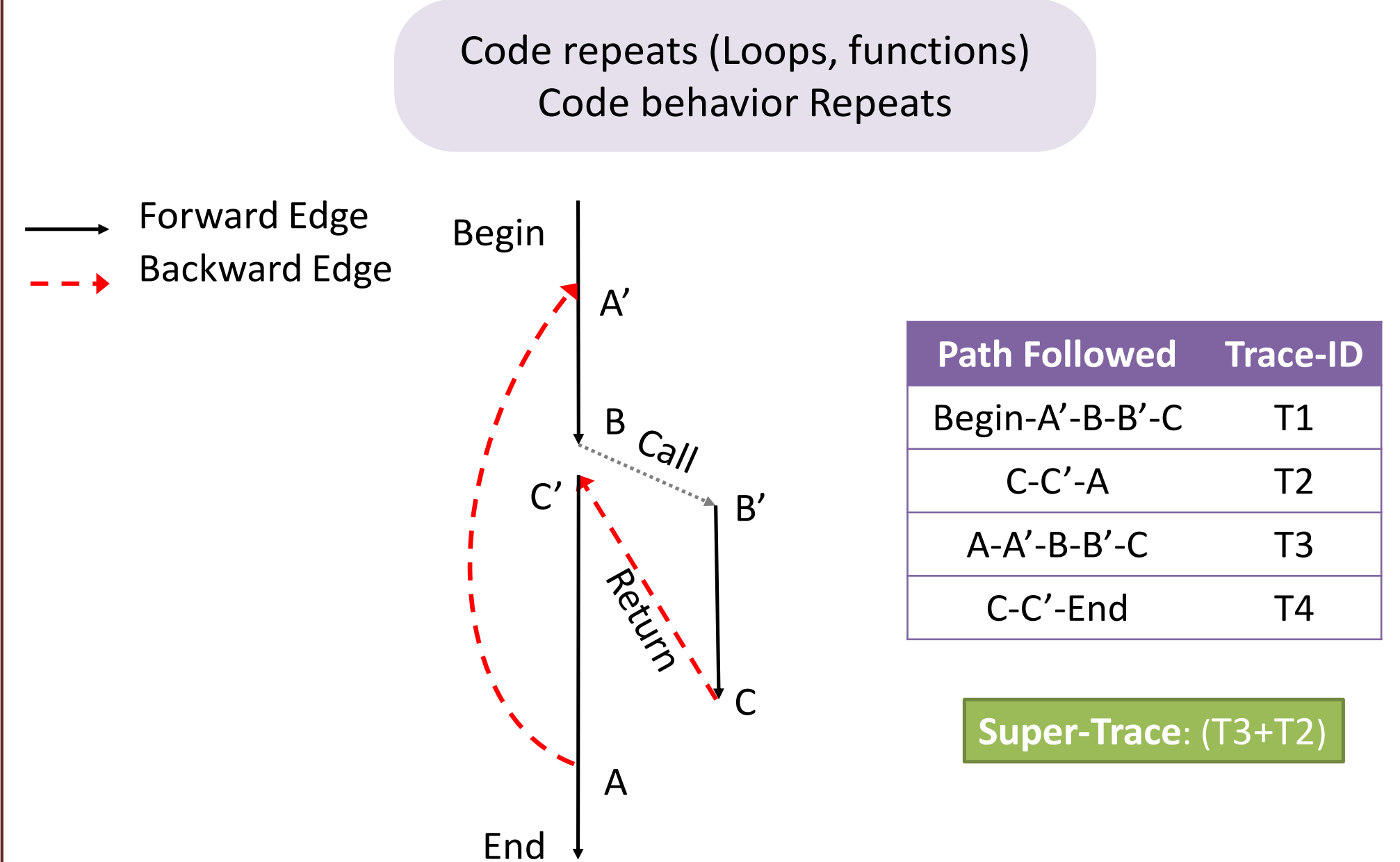## Traditional Switching Controllers

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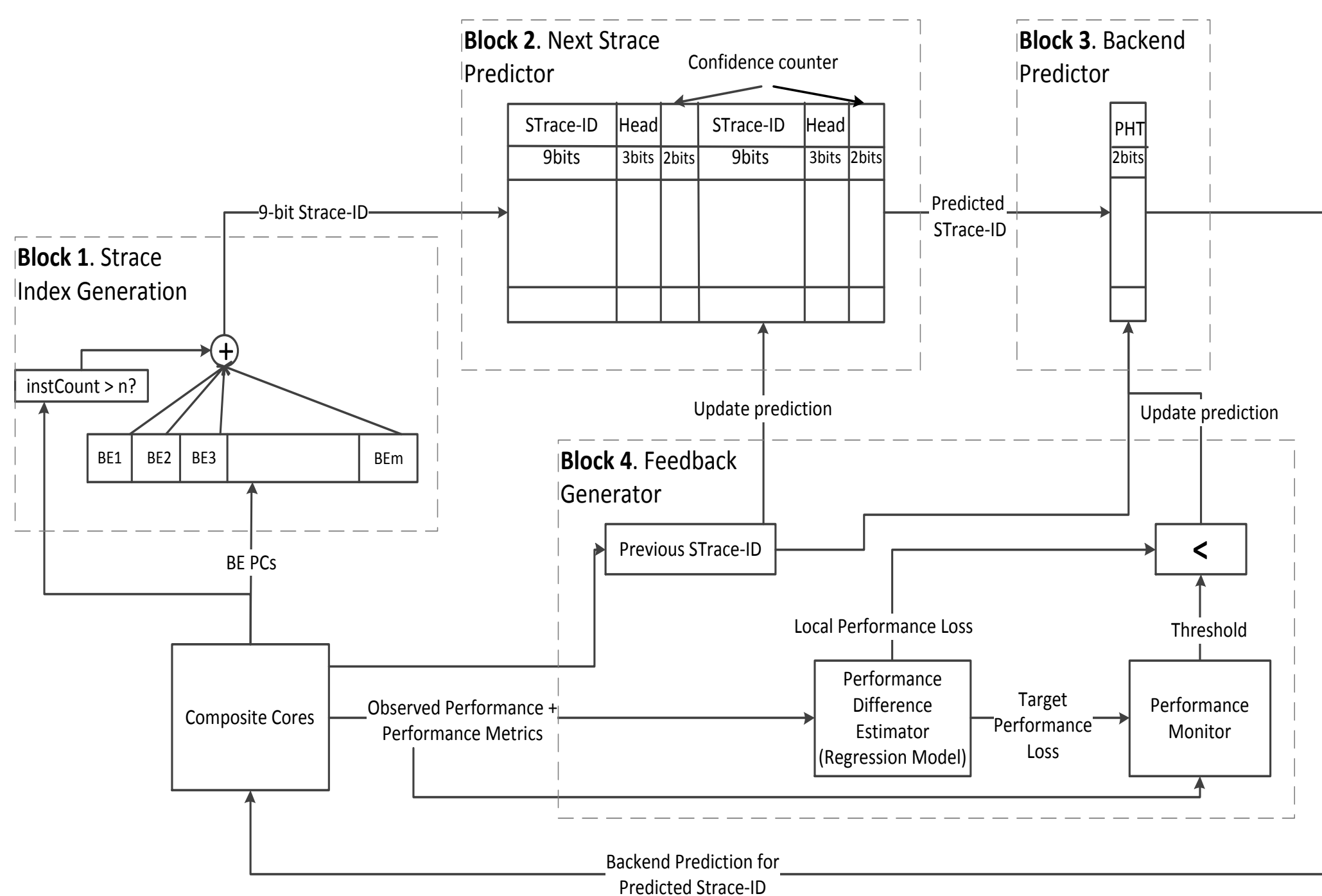## Fine-granularity "Reacts" Poorly

- Traditionally, controllers assume future quanta (intervals) have behaviors similar to recent past

  →*React to performance changes!*

- At fine-granularity, performance varies rapidly between quanta

- Traditional controllers cannot react promptly enough to capture variation
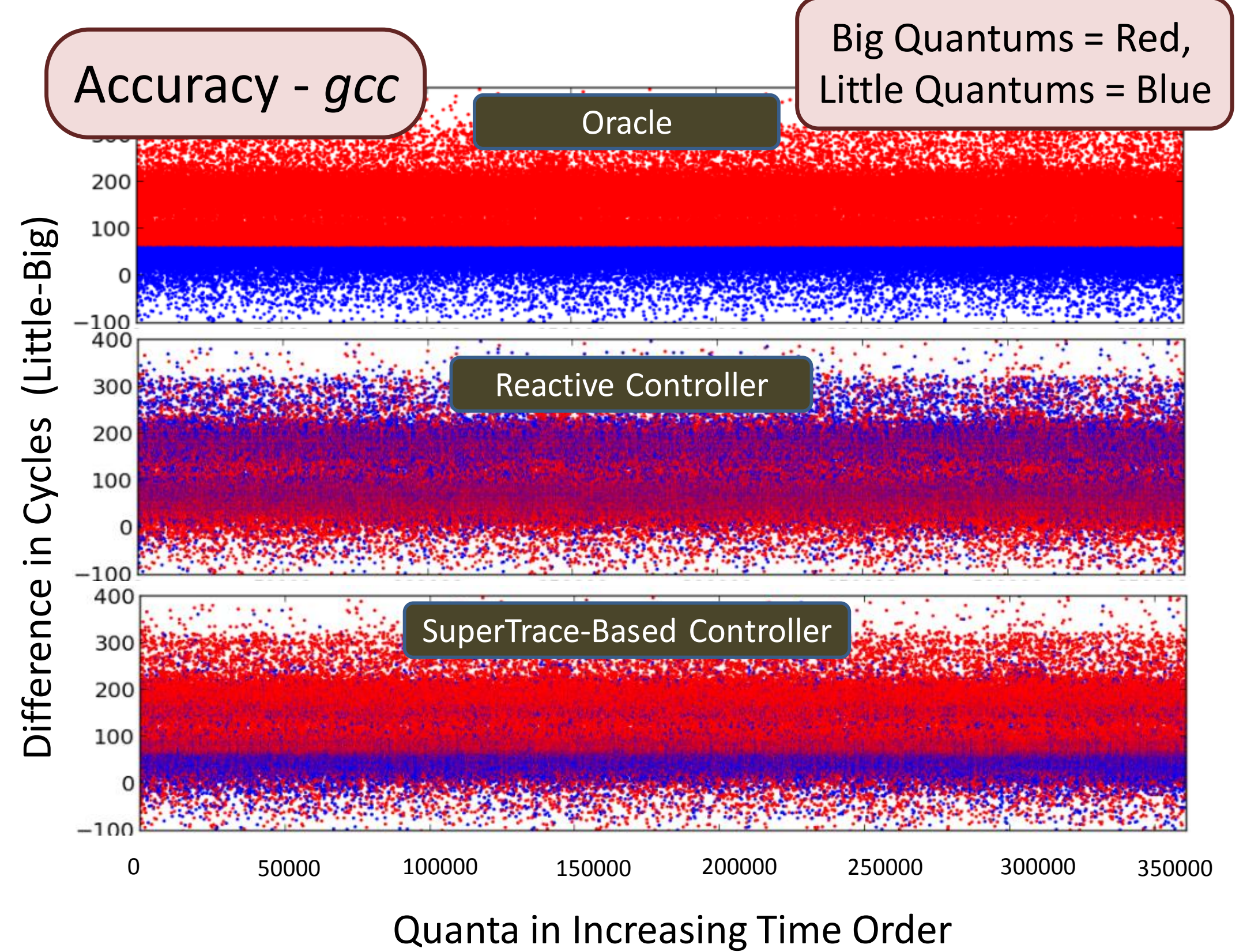
Don't React – Predict!
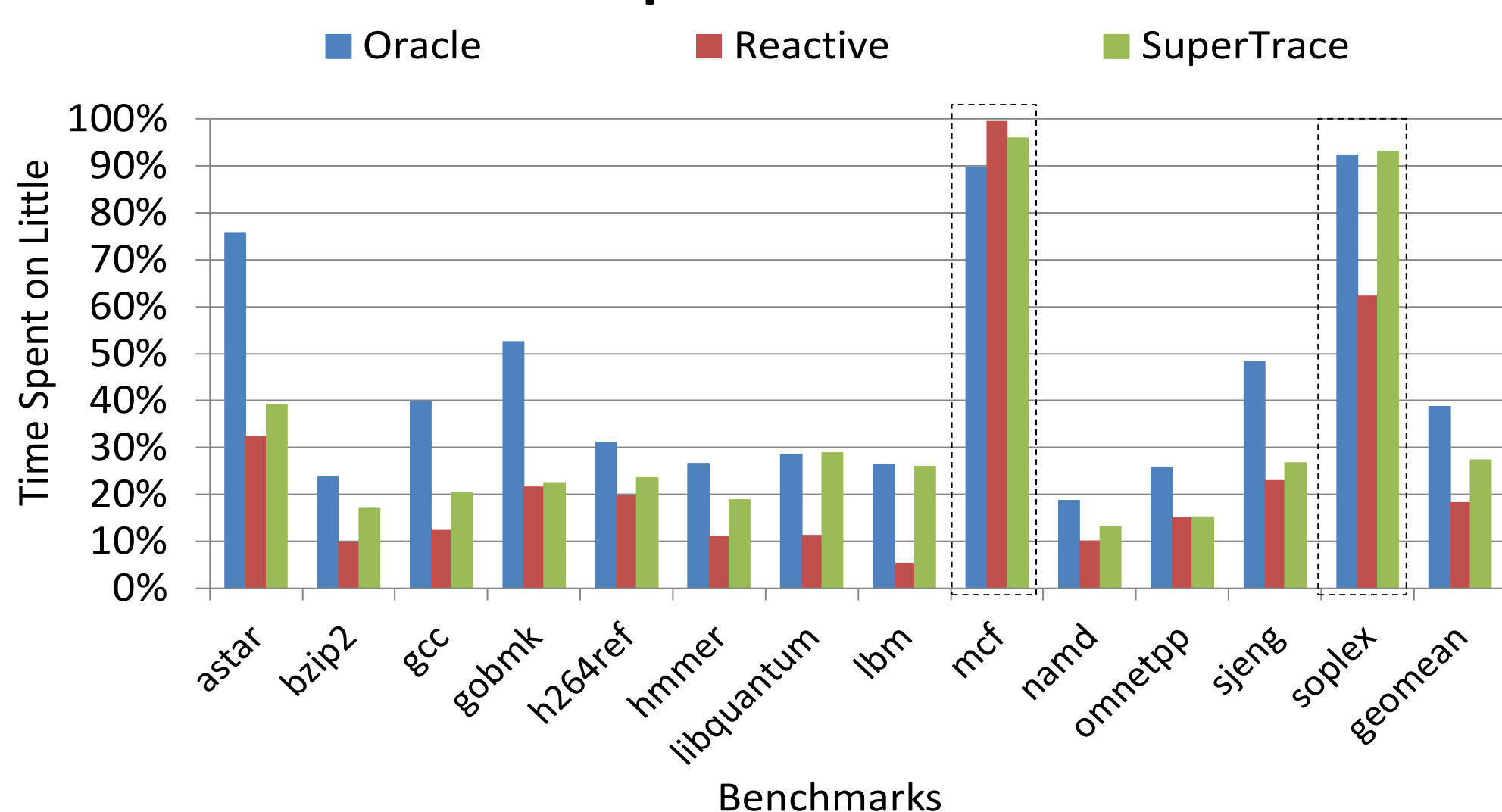

Super-trace Construction

Code repeats (Loops, functions)
Code behavior Repeats

Forward Edge
Backward Edge

Path Followed	Trace-ID
Begin-A'-B-B'-C	T1
C-C'-A	T2
A-A'-B-B'-C	T3
C-C'-End	T4

Super-Trace: (T3+T2)

Trace-Based Controller Overview

Accuracy - *gcc*

Big Quantums = Red,
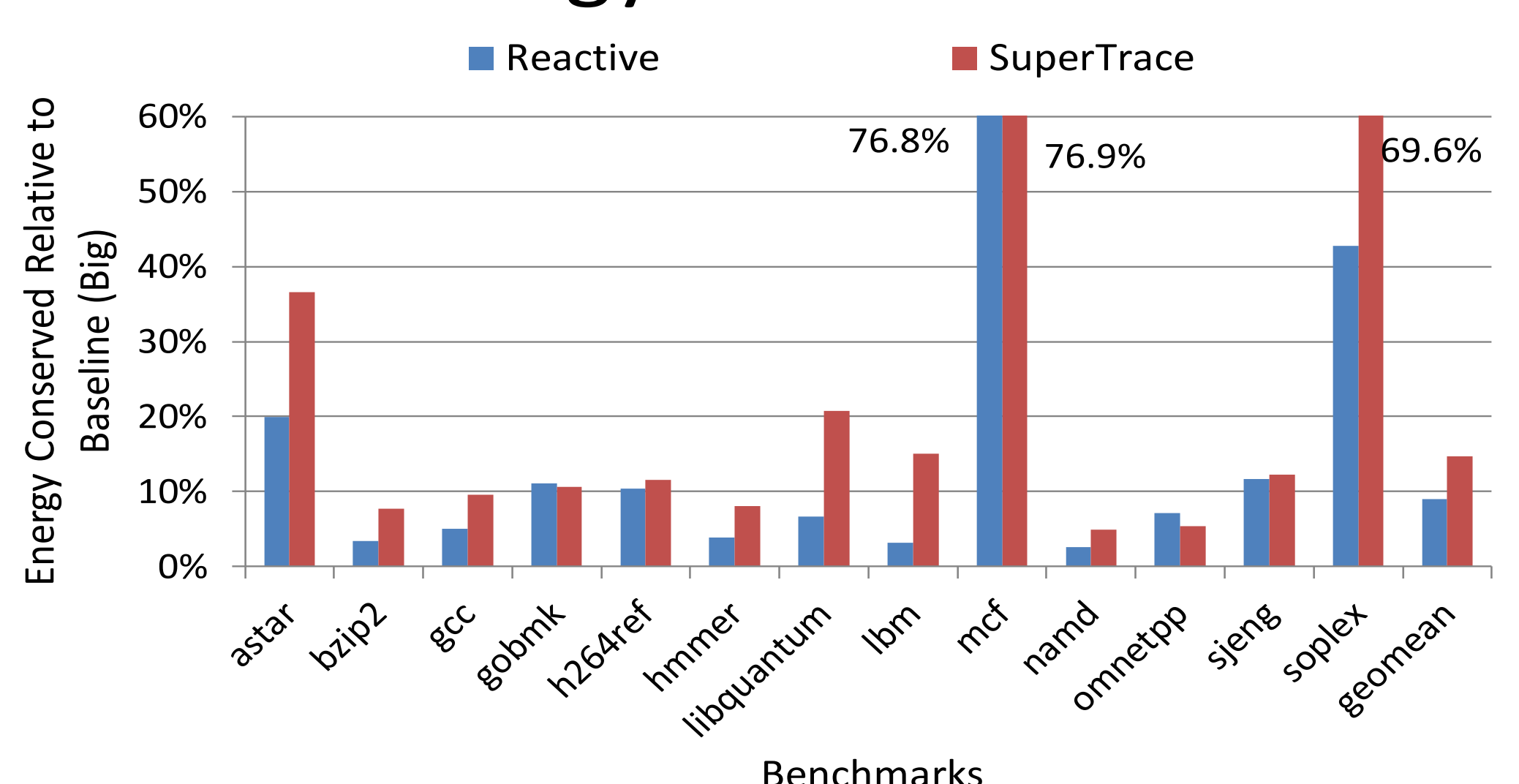Little Quantums = Blue

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Time Spent on Little

Time spent on the Little backend increases by 46% on average

Energy Conservation

On average, we conserve 43% more energy than a reactive controller