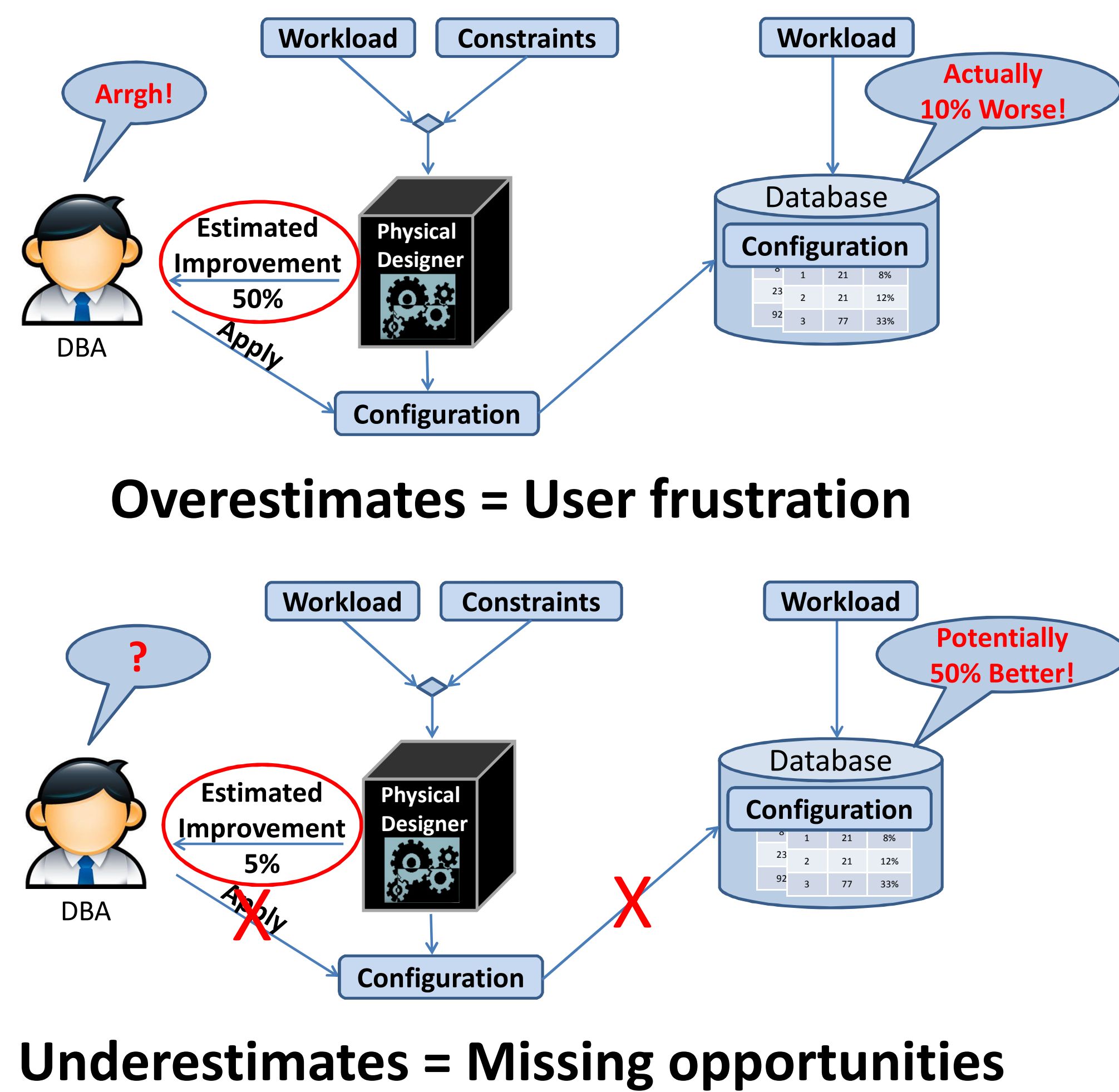


Automated Physical Designers: What You See is (Not) What You Get

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Predictability in Physical Design

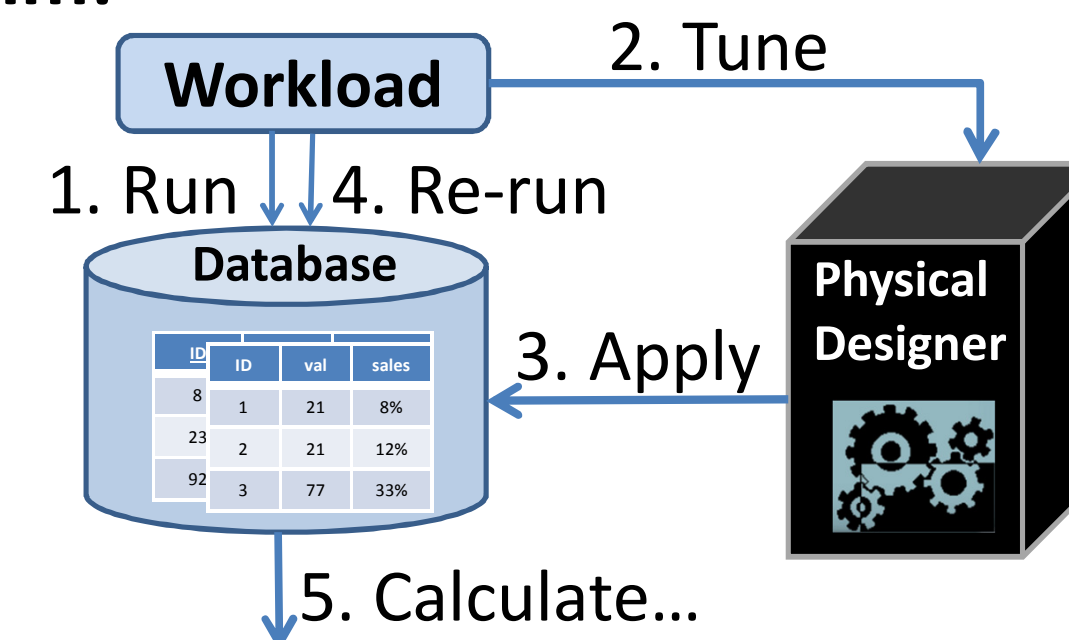


Methodology

Compare different physical database designers in terms of their predictability.

Predictability = difference between estimated and actual improvement

Algorithm:



Questions:

- Does space budget matter?
- What about workload size?
- Introducing updates?
- What about database size?
- Do statistics matter?

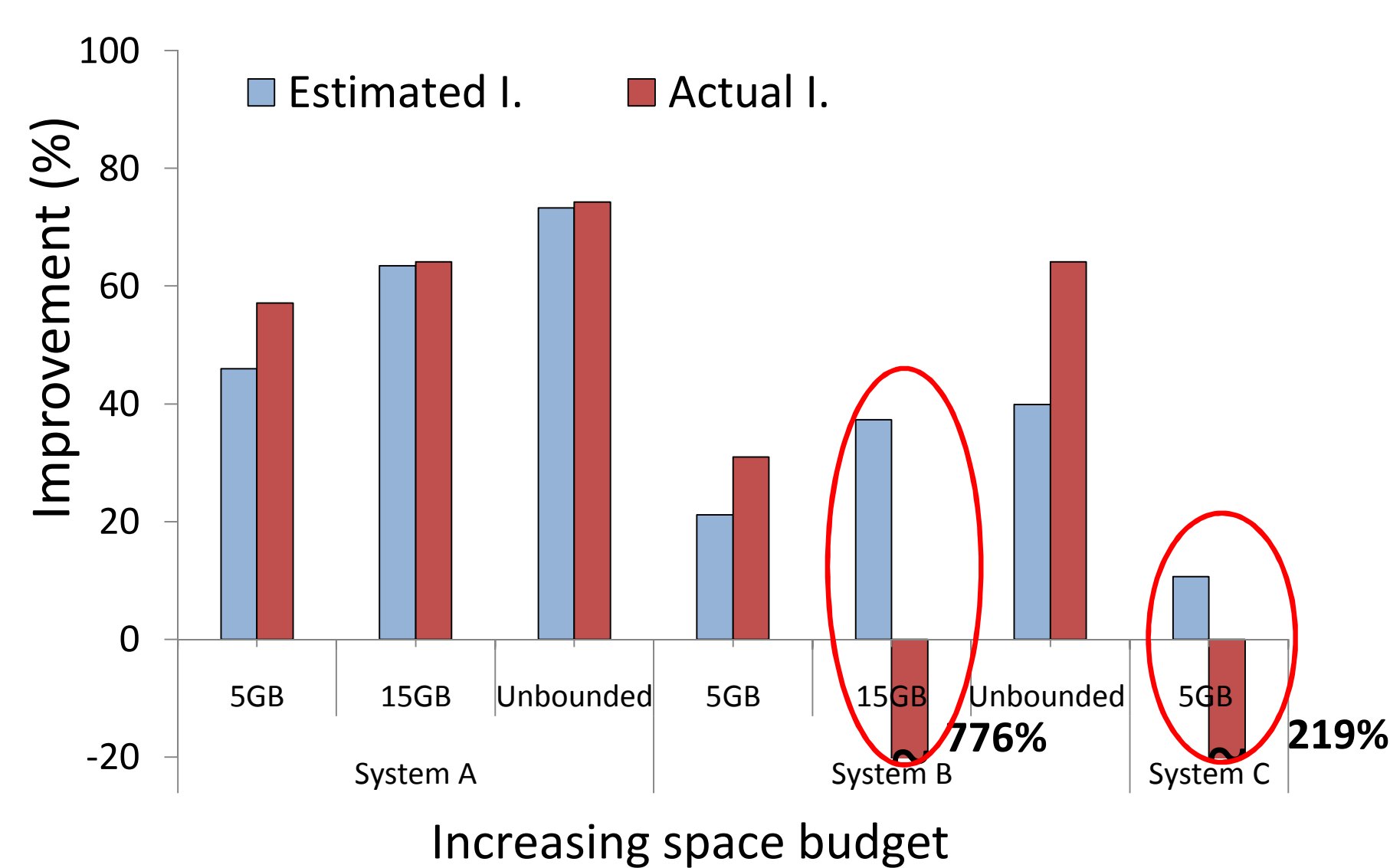
Metrics:

Metric	Label	Formula
Actual improvement (%)	I_A	$I_A = \left(1 - \frac{\text{Tuned_time}}{\text{Original_time}}\right) \times 100$
Estimated tuned time (sec)	E_{TT}	$E_{TT} = \text{Original_time} - \frac{I_E \times \text{Original_time}}{100}$
Relative estimation error (%)	R_{EE}	$R_{EE} = \frac{E_{TT} - \text{Tuned_time}}{\text{Tuned_time}} \times 100$

Impact of Space Budget

Analyzing predictability

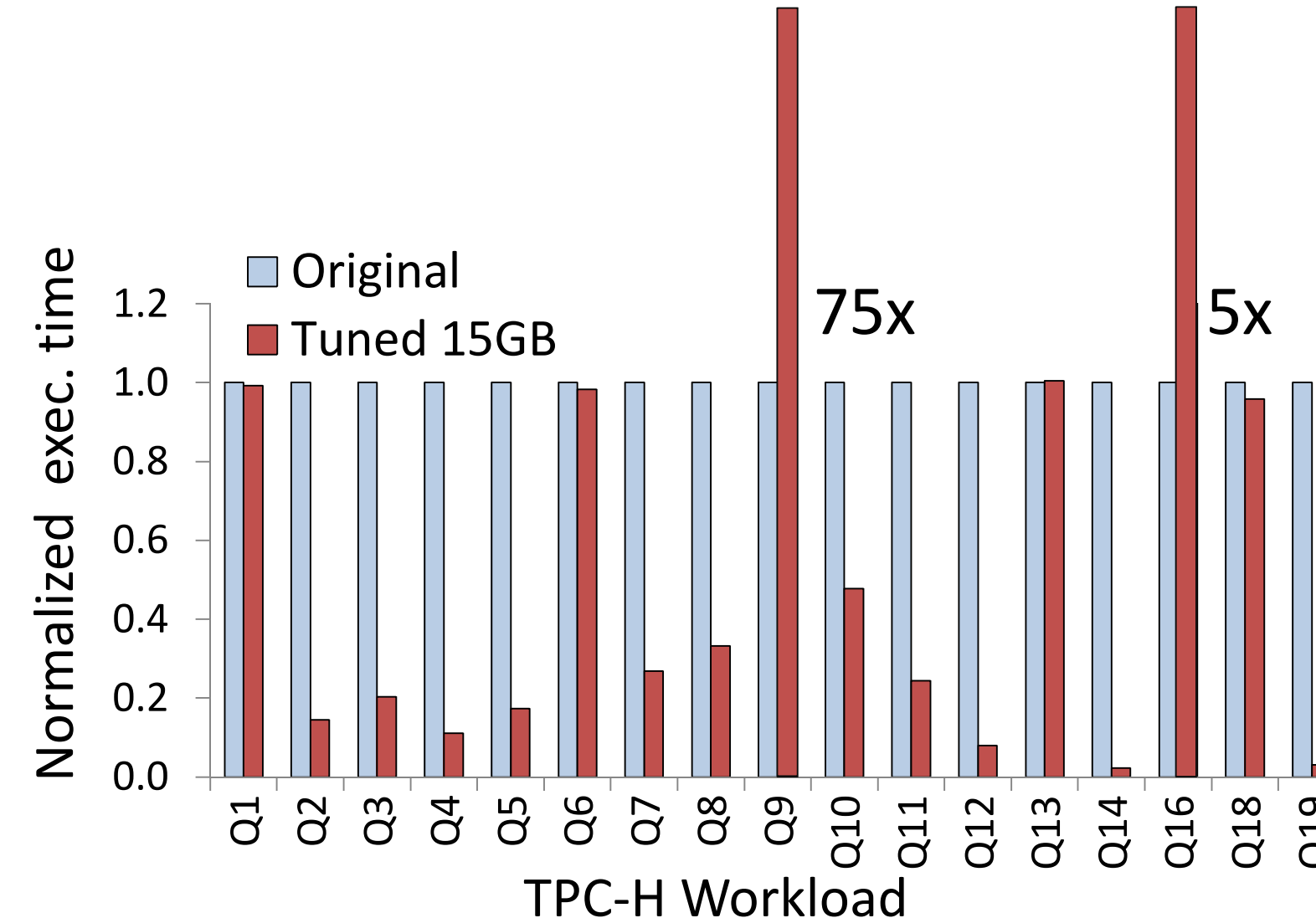
Setting: TPC-H (SF10), Time unlimited



- Improvement typically higher than estimated
- Applied designs degrade performance

Analyzing performance degradation

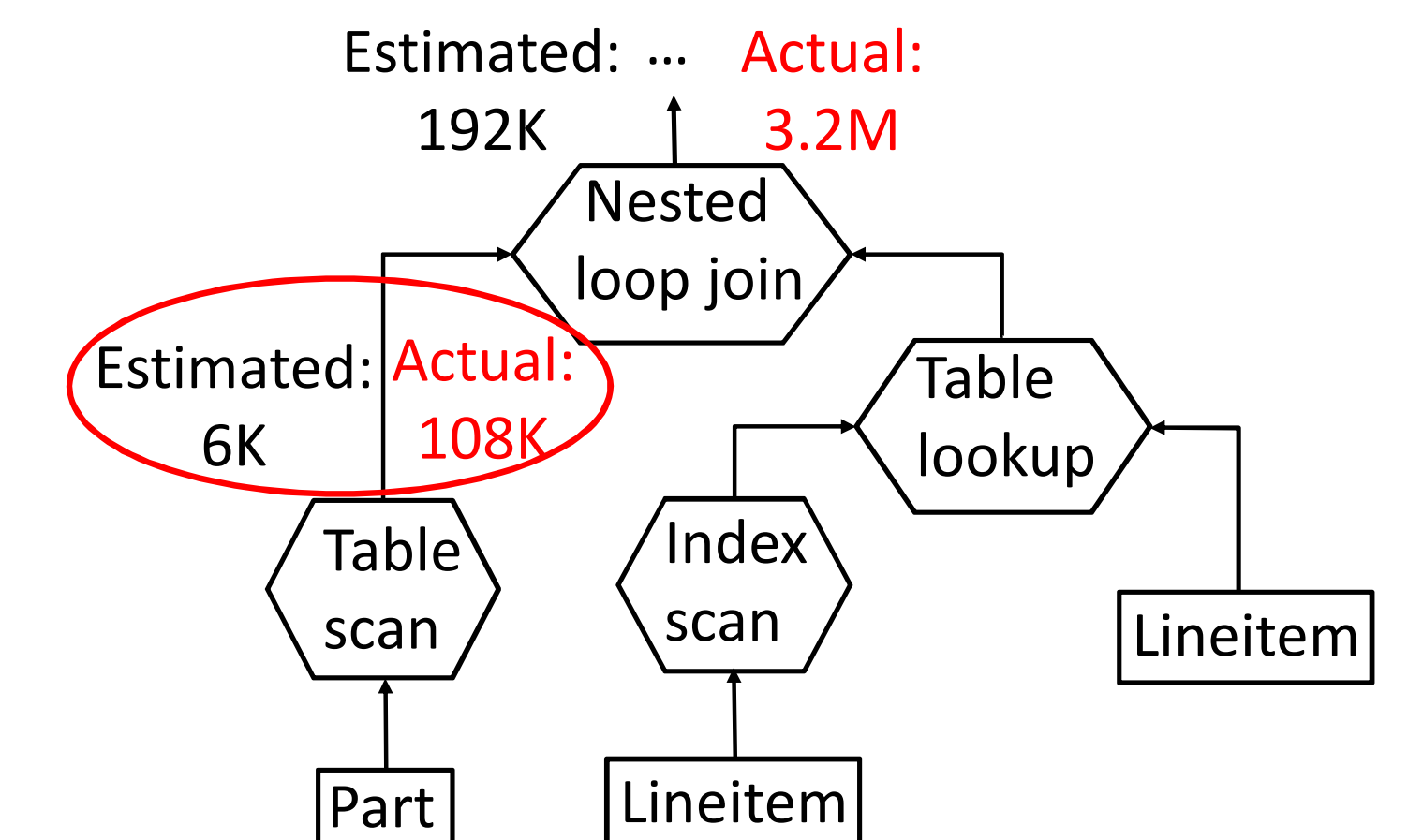
Setting: TPC-H (SF10), System B, Space budget 15GB



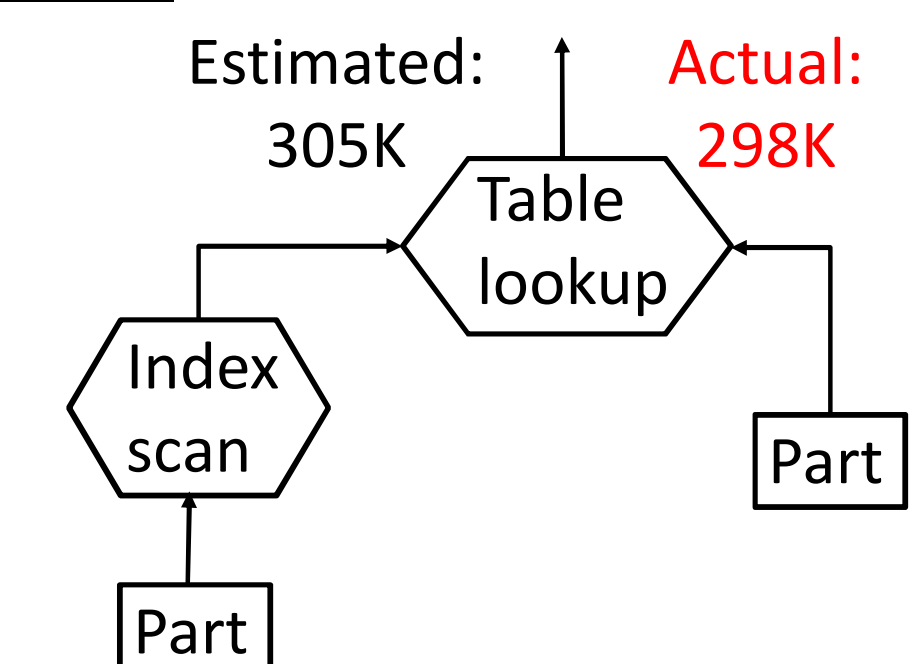
- 2 Queries prolonged overall execution by 8x

Cause for sub-optimal plans

Cardinality errors

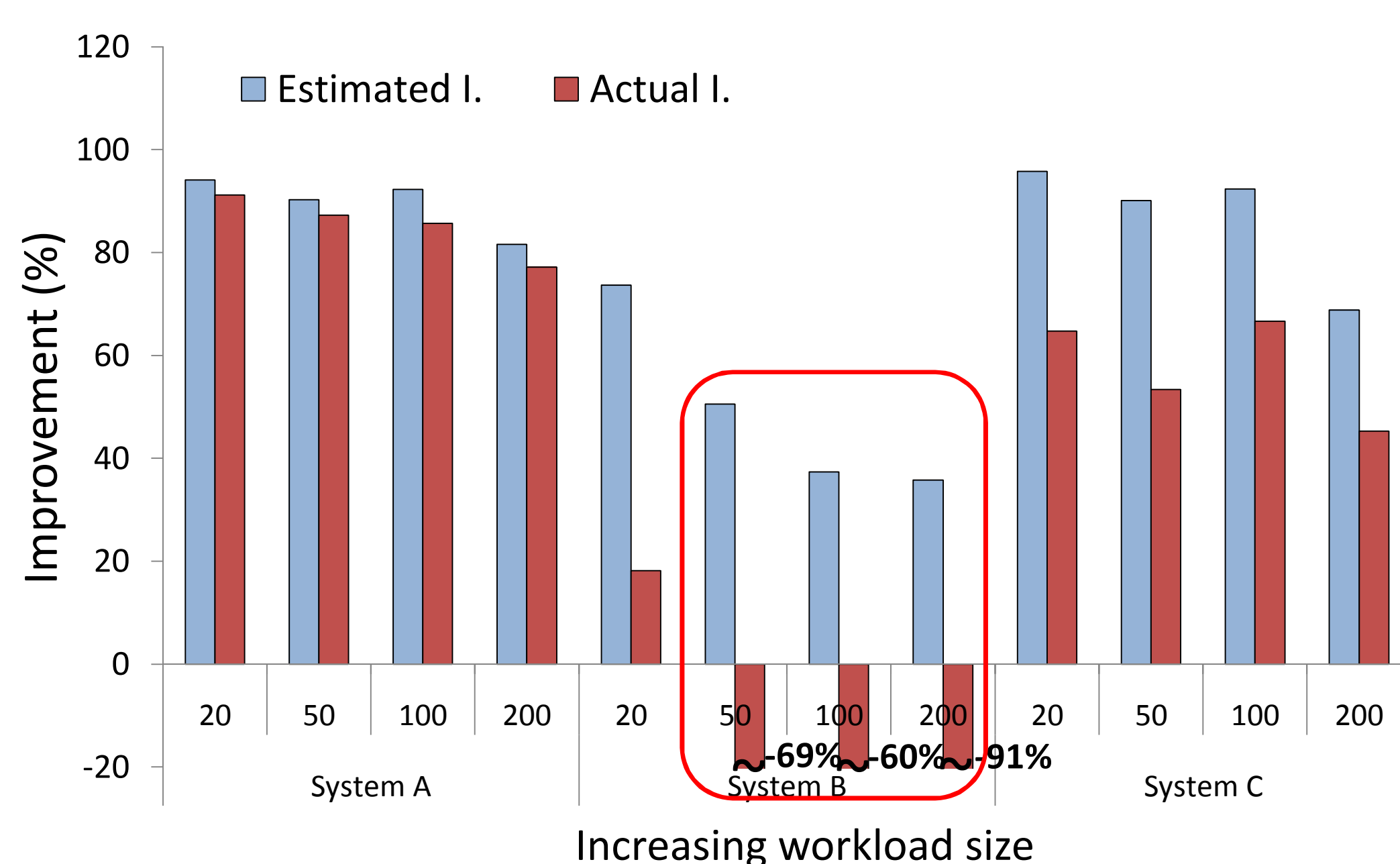


Cost model



Impact of Workload Size

Setting: NREF, Space budget 20GB, Time budget 30min



- Improvement lower than estimated
- Wrong cardinality estimates hurt performance

What About Updates?

Setting: NREF, Space budget 20GB, Time budget 30min, 400 statements

Metric	System A	System B	System C
I_E (%)	58.62	-	2.23
I_A (%)	-18.3	-	-8.13
R_{EE} (%)	65.02	-	9.58

- Cannot balance improvement and maintenance

Summary

Proposed designs can be unpredictable

System A:

- R_{EE} below 46%, performance hurt for 18% only with updates

System B:

- R_{EE} up to 92%, performance hurt up to 776%

System C:

- R_{EE} up to 87%, performance hurt up to 219%