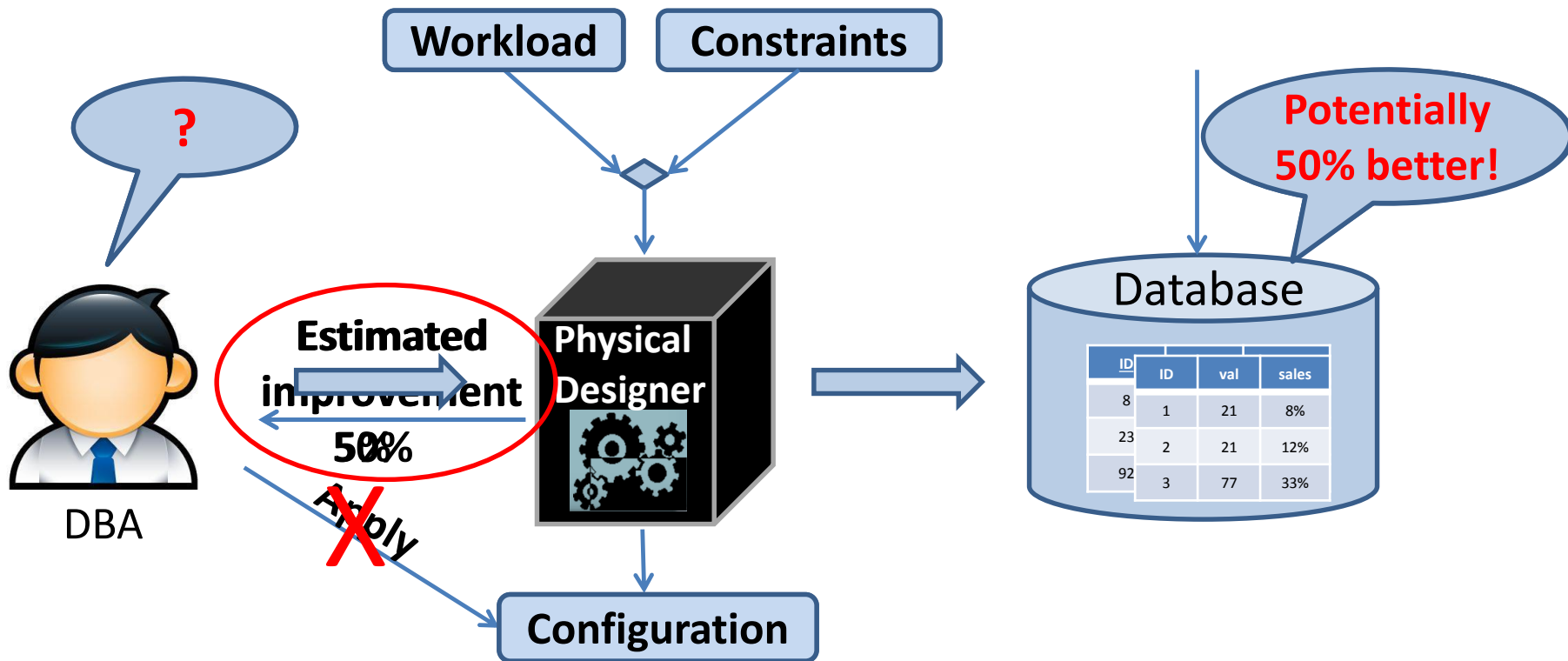


# Automated Physical Designers: What You See is What You Get?

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Anastasia Ailamaki

# Physical designers' estimates

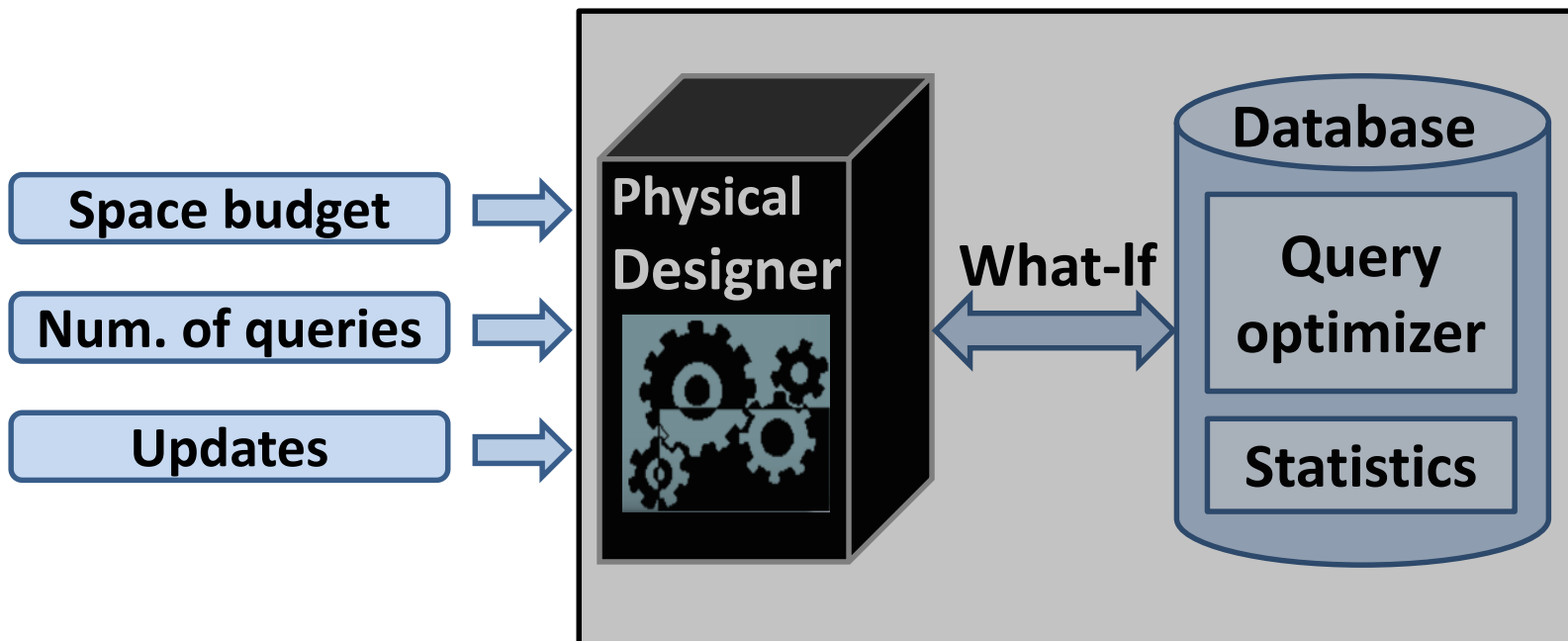


**Overestimates = User frustration**

**Underestimates = Missing opportunities**

# Our approach

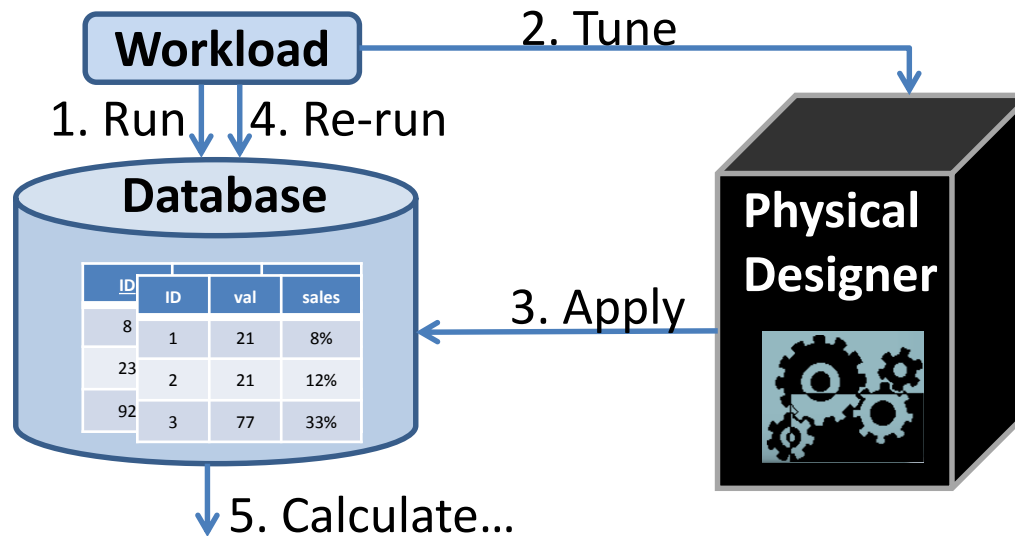
Compare existing physical database designers in terms of predictability (actual vs. estimated improvement).



# Experimental setup

- Hardware
  - 2 x 4-core AMD 2.7GHz, 32 GB, Win 2008 R2
  - I/O: 2 x 750 GB SATA 7200rpm, RAID 0, 90 MB/s
- Commercial DBMS
  - System A, System B, System C
  - Buffer pool 20% of DB size, cold runs, updated statistics
- Workloads
  - TPC-H: SF (10 and 100), 17 queries
  - NREF: 6.7GB, 200 queries

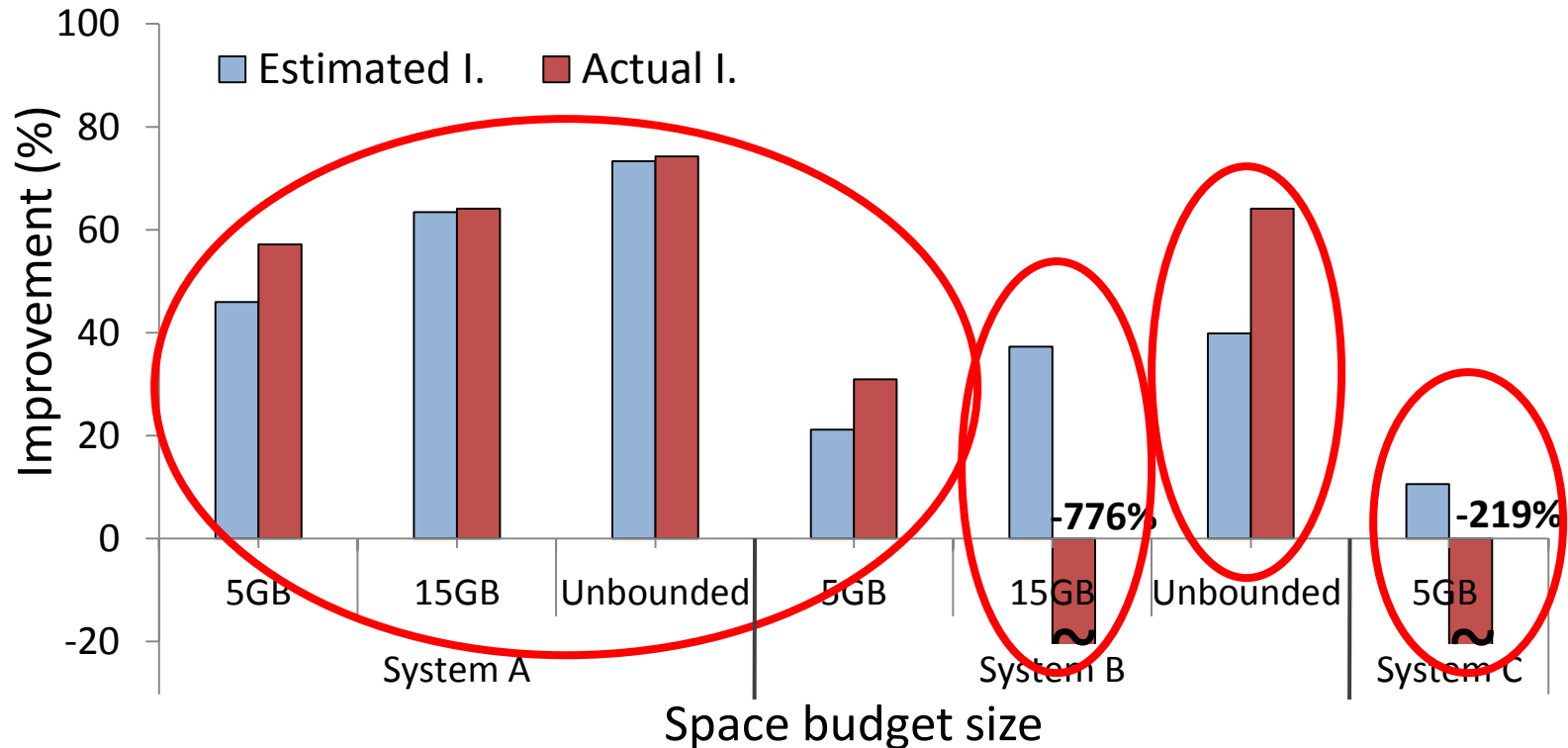
# Experimental methodology



Metric	Label	Formula
Actual improvement (%)	$I_A$	$\left(1 - \frac{\text{Tuned\_time}}{\text{Original\_time}}\right) \times 100$
Estimated tuned time (sec)	$E_{TT}$	$\text{Original\_time} - \frac{\text{Estimated\_improvement} \times \text{Original\_time}}{100}$
<b>Relative estimation error (%)</b>	<b><math>R_{EE}</math></b>	<b><math>\frac{E_{TT} - \text{Tuned\_time}}{\text{Tuned\_time}} \times 100</math></b>

# Impact of space budget

**Setting:** TPC-H, SF10, Unlimited time

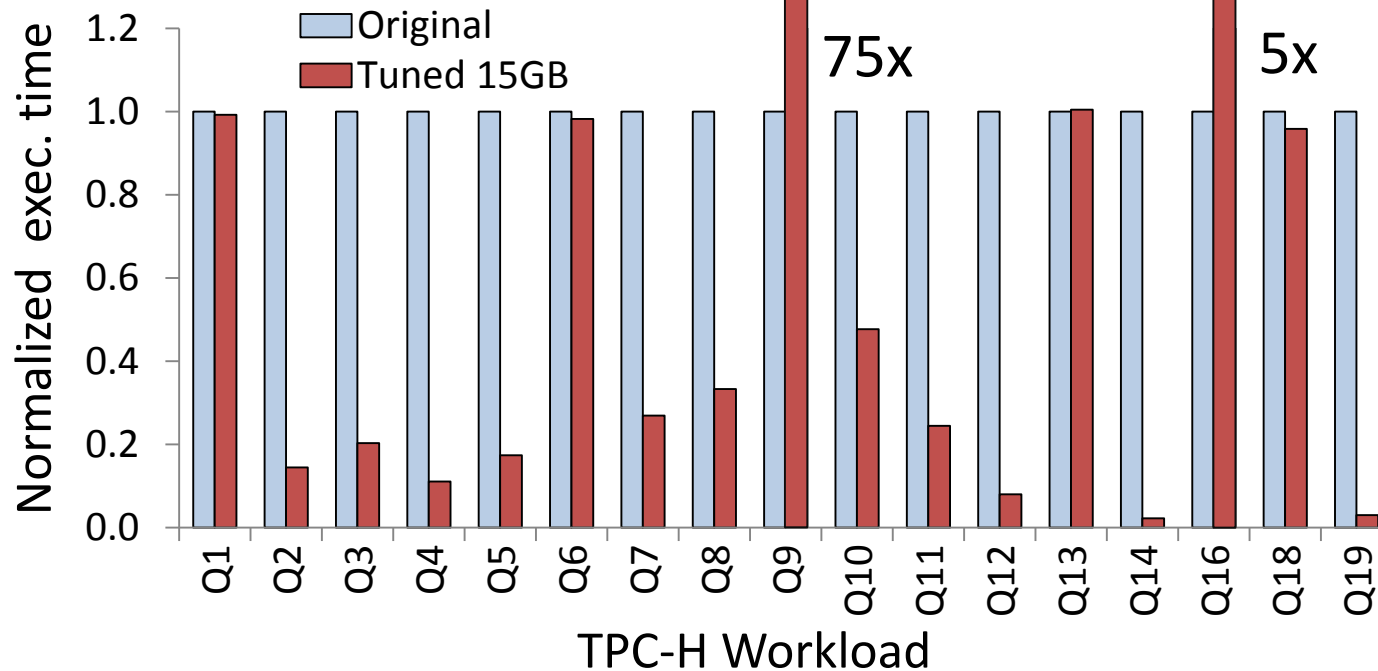


**Improvement usually higher than estimated**

**Performance hurt in Systems B and C**

# Analyzing performance degradation

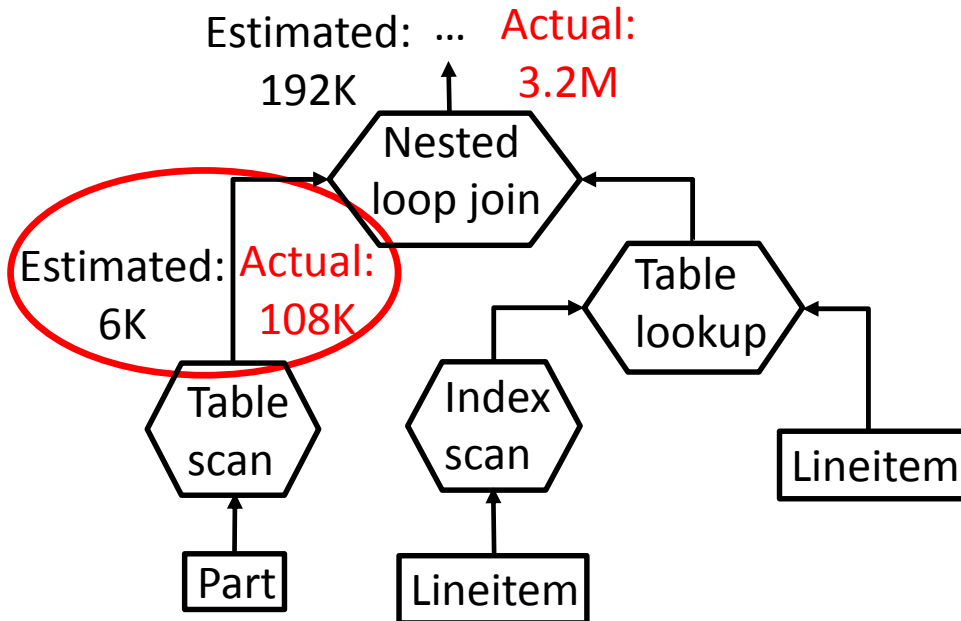
**Setting:** TPC-H, SF10, System B, Space budget 15 GB



**Two queries prolonged workload execution 8 times**

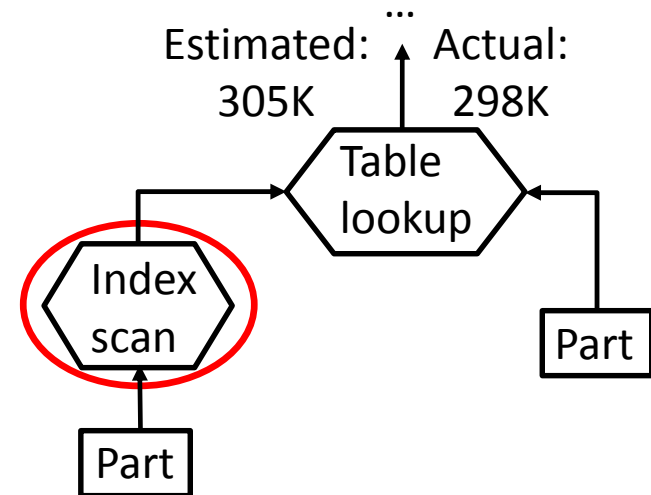
# Cause for sub-optimal plans

- Cardinality errors



- Order of magnitude more tuples
- 75x longer execution time!

- Cost model



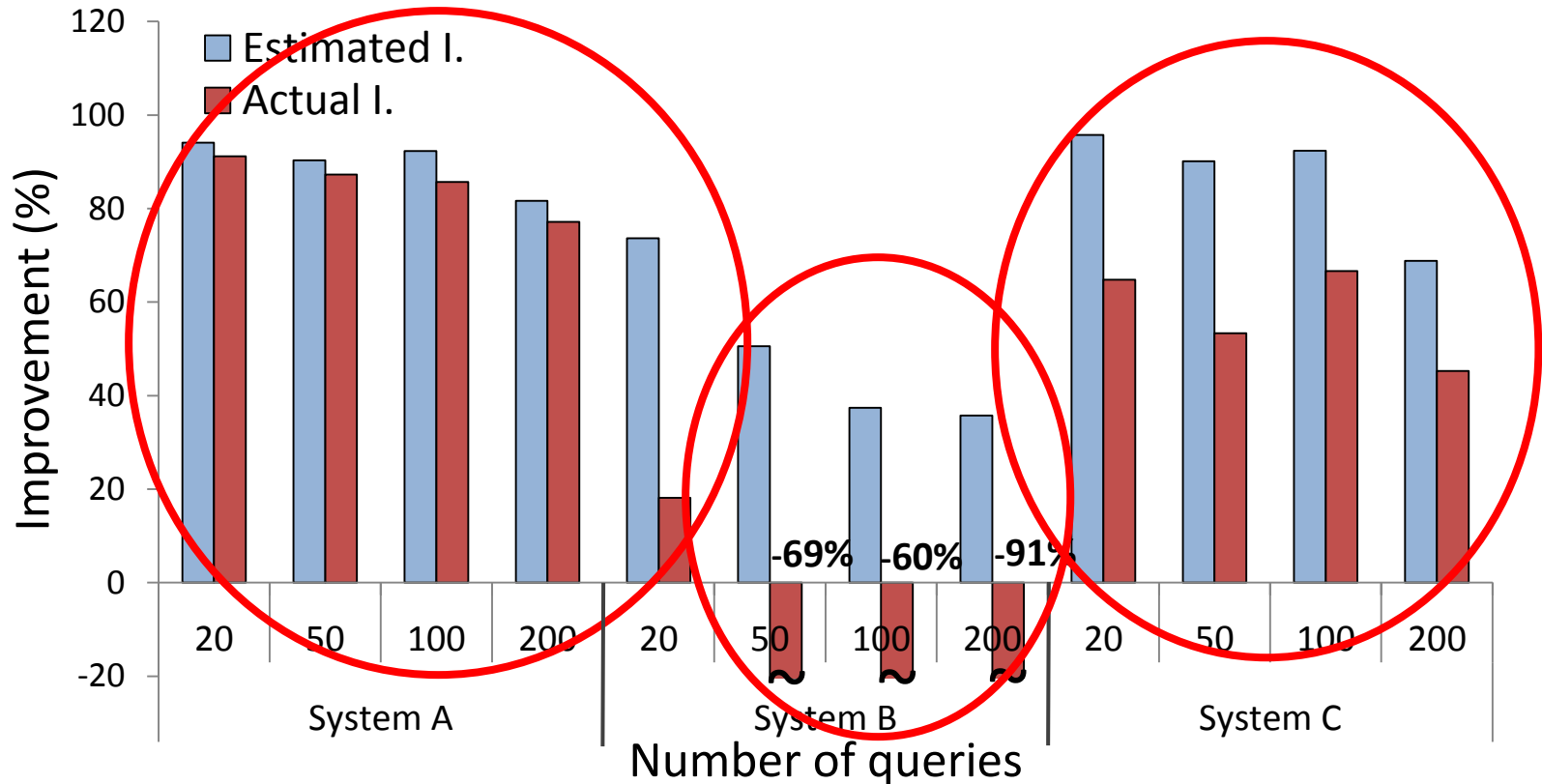
- Wrong decision of cost model
- 5x longer execution time!

**Optimizer's mistakes -> mislead designer -> hurt predictability**



# Increasing number of queries

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



**Improvement lower than estimated**

**Wrong cardinalities hurt performance of System B!**

# Impact of updates

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

Metric	System A	System B	System C
Estimated I. (%)	58.62	--	2.23
Actual I. (%)	<b>-18.3</b>	--	<b>-8.13</b>
Relative error (%)	65.02	--	9.58

**Complex trade-off between improvement and maintenance**

# Summary

- System A
  - Relative error 2 – 46 % in read-only workloads
  - Performance hurt by 18% only in update-intensive workload
- System B
  - Relative error 14 – 92 % in read-only workloads
  - Performance hurt up to 8x after tuning
- System C
  - Relative error 42 – 87 % in read-only workloads
  - Performance hurt up to 2x after tuning

**What you see is ~~not~~ what you get**

# Thank you!

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