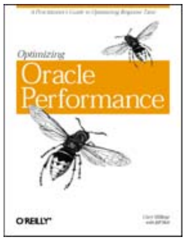
Why you can’t see your real performance problems

Cary Millsap (cary.millsap@hotsos.com)
Hotsos Enterprises, Ltd.

Northern California Oracle Users Group / San Francisco
9:30am–10:30am Thursday 2 November 2006



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Oracle. Performance. Now.

Agenda

- Two distinct modes of operational management
- Diagnosis and repair: how to begin
- Why performance improvement projects fail
- Skew in diagnostic data
- The whole story in under a minute

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Two distinct modes of operational management

Routine maintenance versus diagnosis and repair

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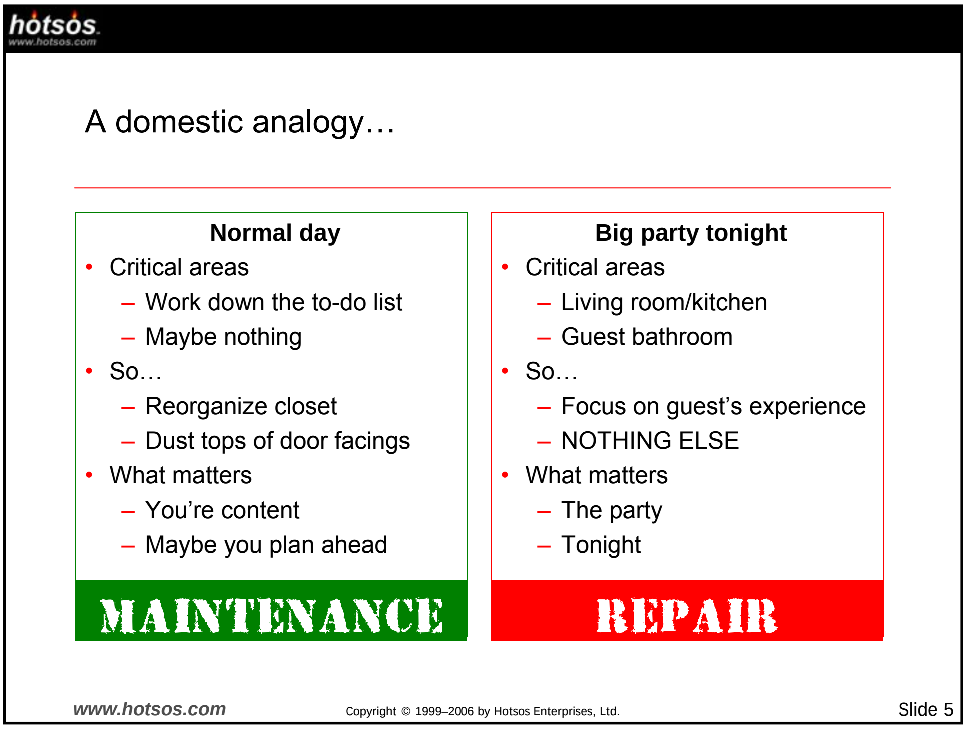

A domestic analogy…

Normal day

- Critical areas
  - Work down the to-do list
  - Maybe nothing
- So…
  - Reorganize closet
  - Dust tops of door facings
- What matters
  - You're content
  - Maybe you plan ahead

MAINTENANCE

Big party tonight

- Critical areas
  - Living room/kitchen
  - Guest bathroom
- So…
  - Focus on guest's experience
  - NOTHING ELSE
- What matters
  - The party
  - Tonight

REPAIR

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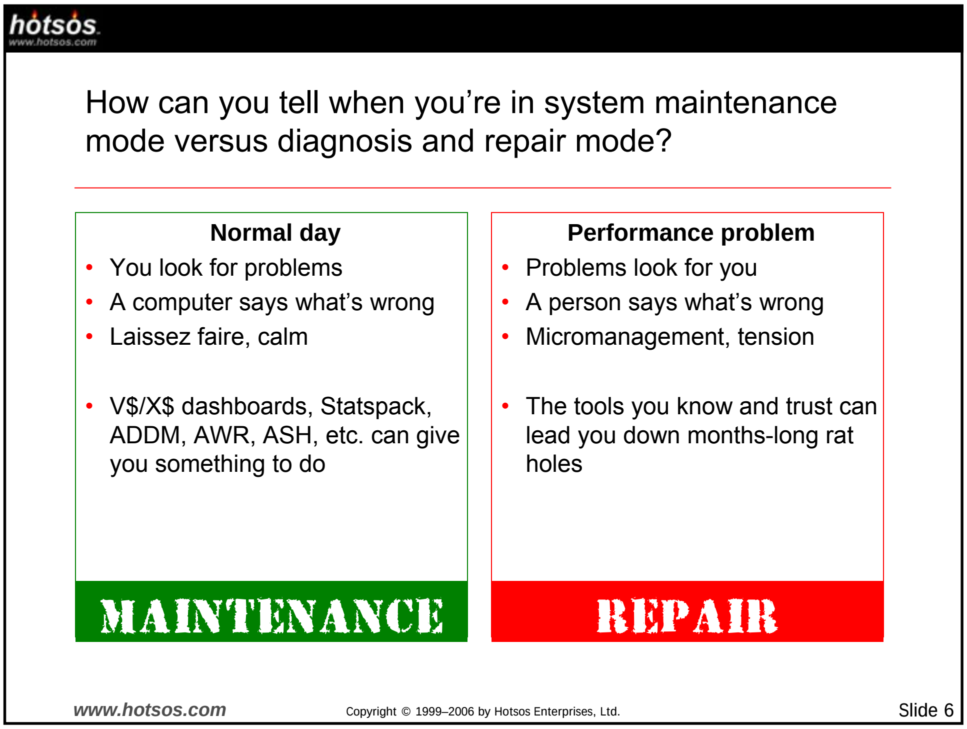

How can you tell when you're in system maintenance mode versus diagnosis and repair mode?

Normal day

- You look for problems
- A computer says what's wrong
- Laissez faire, calm

- V$/X$ dashboards, Statspack, ADDM, AWR, ASH, etc. can give you something to do

MAINTENANCE

Performance problem

- Problems look for you
- A person says what's wrong
- Micromanagement, tension

- The tools you know and trust can lead you down months-long rat holes

REPAIR

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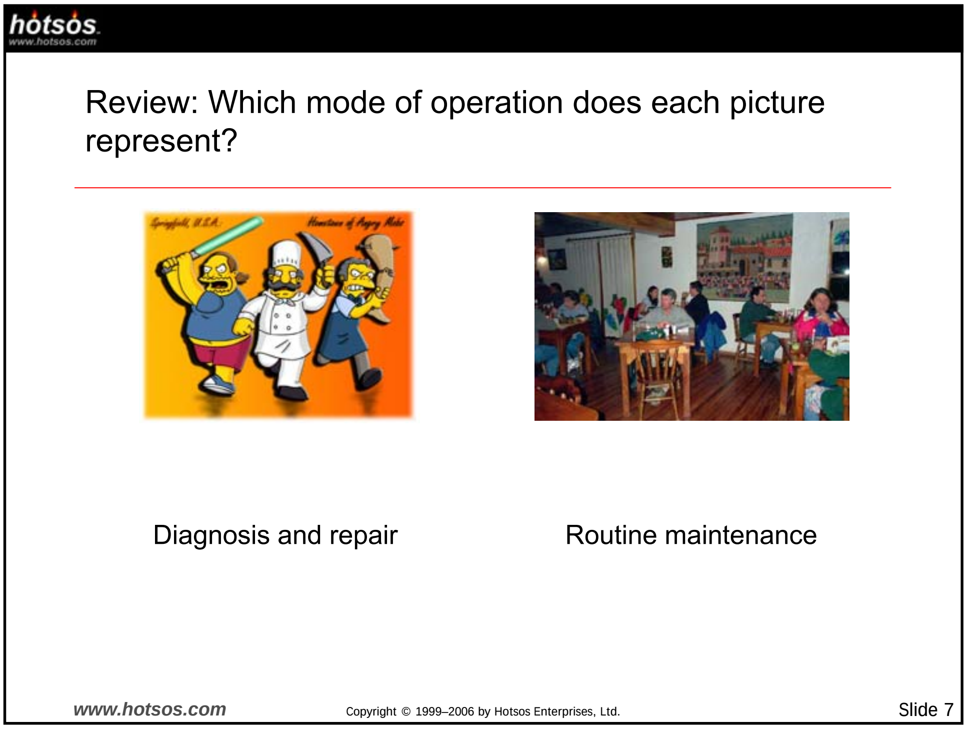

Review: Which mode of operation does each picture represent?

Springfield, U.S.A.
Hometown of Angry Mobs

Diagnosis and repair

Routine maintenance

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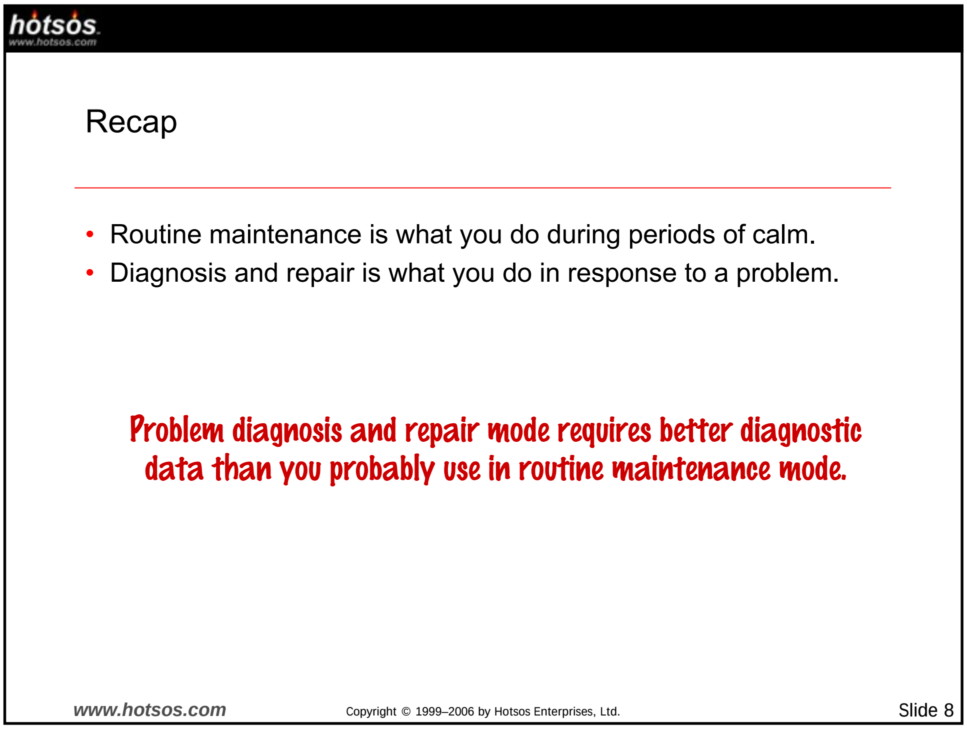

Recap

- Routine maintenance is what you do during periods of calm.
- Diagnosis and repair is what you do in response to a problem.

Problem diagnosis and repair mode requires better diagnostic data than you probably use in routine maintenance mode.

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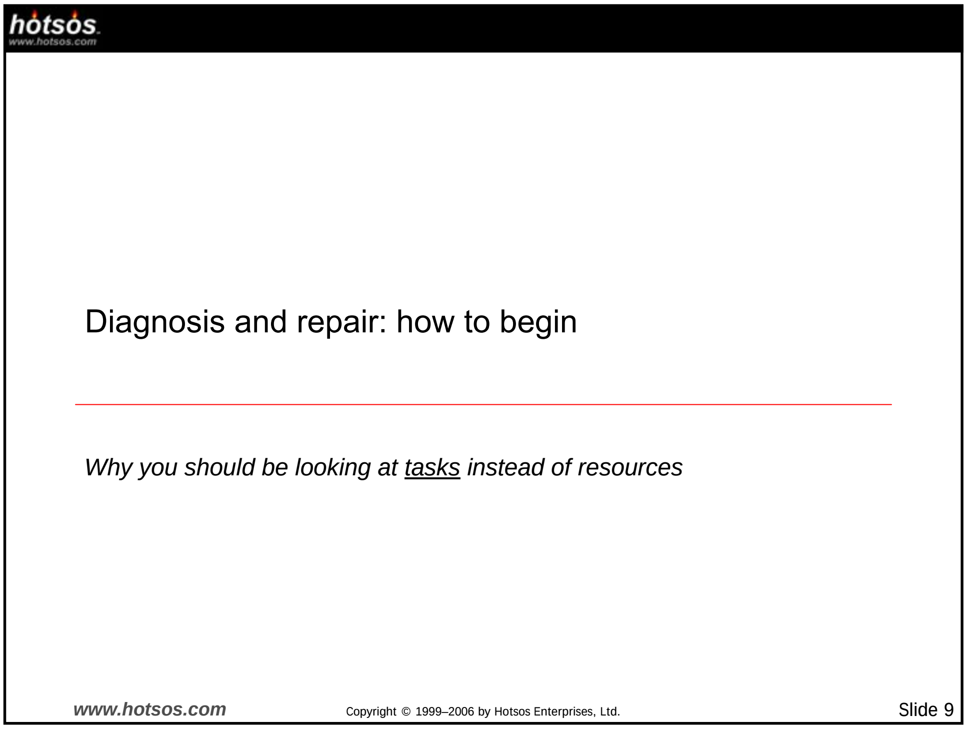

Diagnosis and repair: how to begin

Why you should be looking at tasks instead of resources

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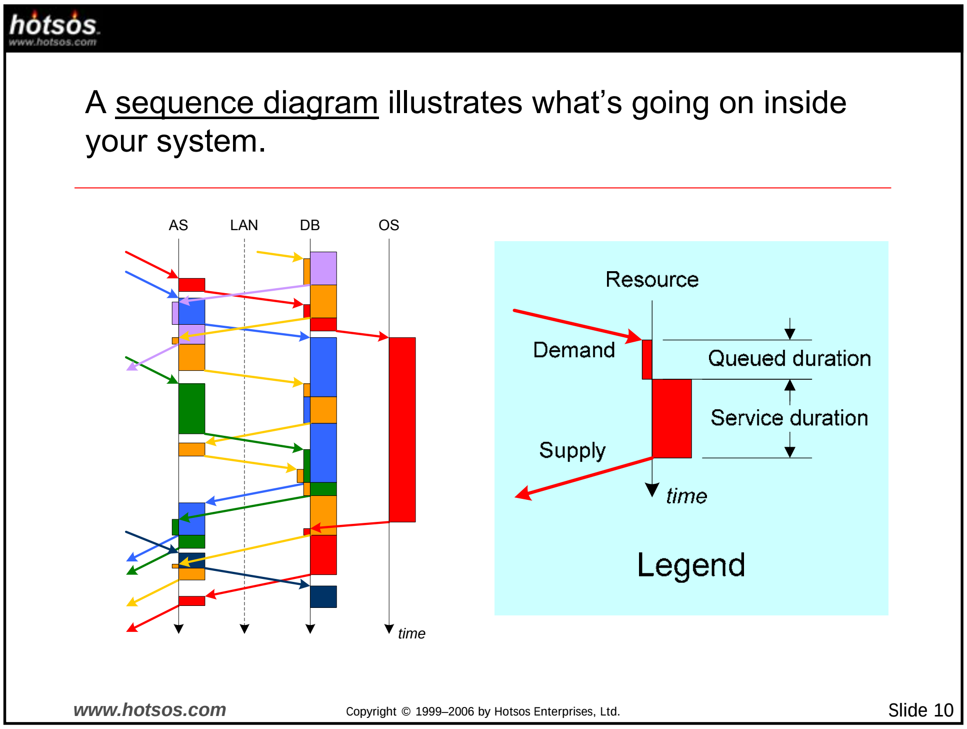

A sequence diagram illustrates what’s going on inside your system.

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Definition of bottleneck…

- The resource with the highest utilization is called the *bottleneck*.
  - [Jain (1991), p34; Muscettola (1993), p241; Allen (1994), p116; et al.]

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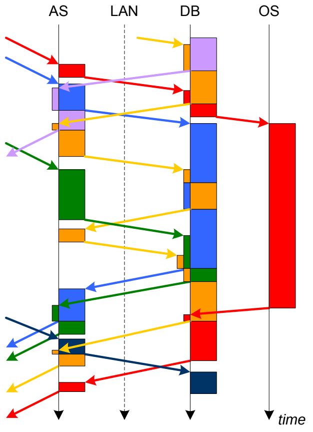
Which resource on this system is the bottleneck?



- It’s easy

- DB
  - Least idle time
  - Highest utilization

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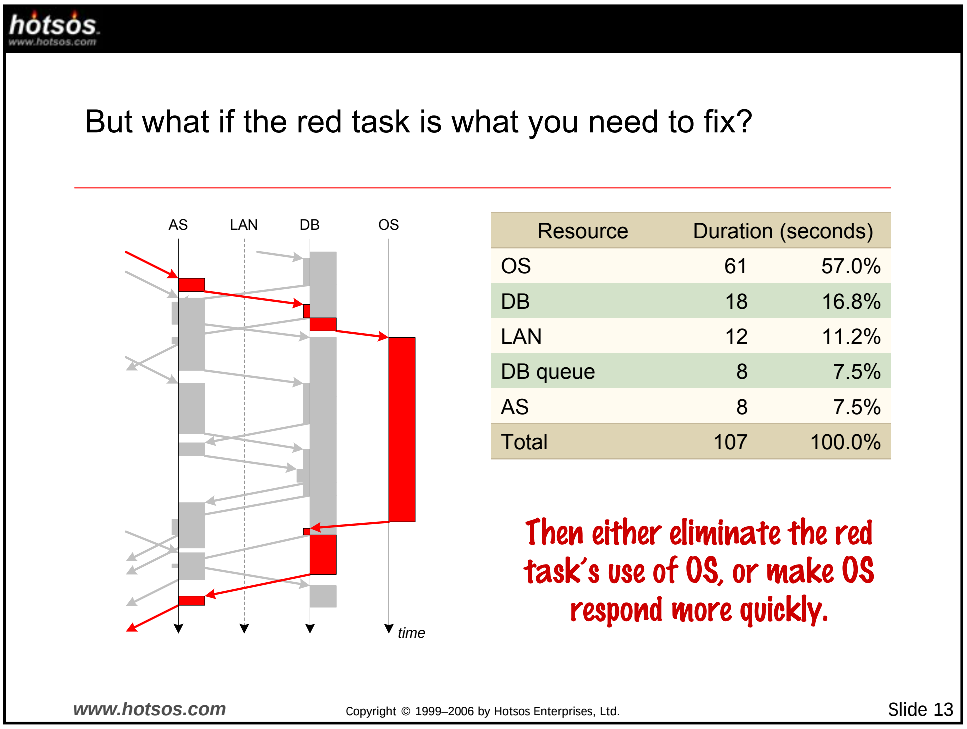

But what if the red task is what you need to fix?

Resource	Duration (seconds)	
OS	61	57.0%
DB	18	16.8%
LAN	12	11.2%
DB queue	8	7.5%
AS	8	7.5%
Total	107	100.0%

Then either eliminate the red task's use of OS, or make OS respond more quickly.

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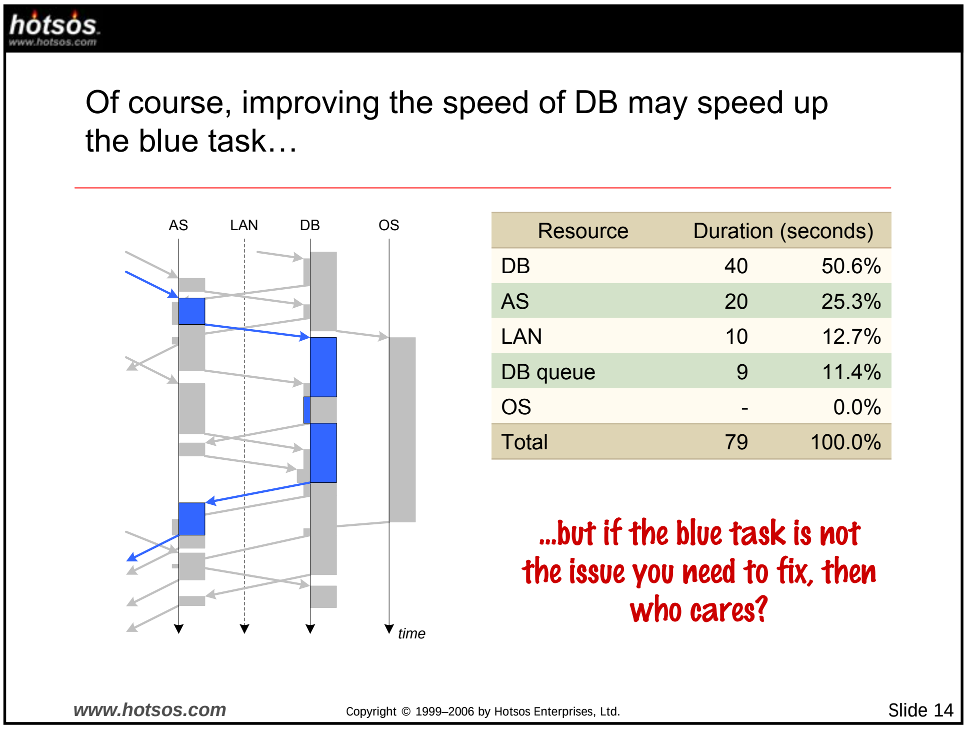

Of course, improving the speed of DB may speed up the blue task…

Resource	Duration (seconds)	
DB	40	50.6%
AS	20	25.3%
LAN	10	12.7%
DB queue	9	11.4%
OS	-	0.0%
Total	79	100.0%

…but if the blue task is not the issue you need to fix, then who cares?

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Definition of bottleneck (reprise)…

- The resource with the highest utilization is called the *bottleneck*.
  - [Jain (1991), p34; Muscettola (1993), p241; Allen (1994), p116; et al.]

True, but misleading, because it omits context.

- The *bottleneck* is the component where a transaction spends most of its time.
  - [Menascé and Almeida (2002), p10]

Much better.

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Recap

- Your business needs you to prioritize your performance repairs by business need.
  - …Which doesn't necessarily map to what your resource monitors say.
- Analyze your tasks in business priority order.
  - …So you'll actually fix what needs fixing.

Make your system work for your business,
not the other way around.

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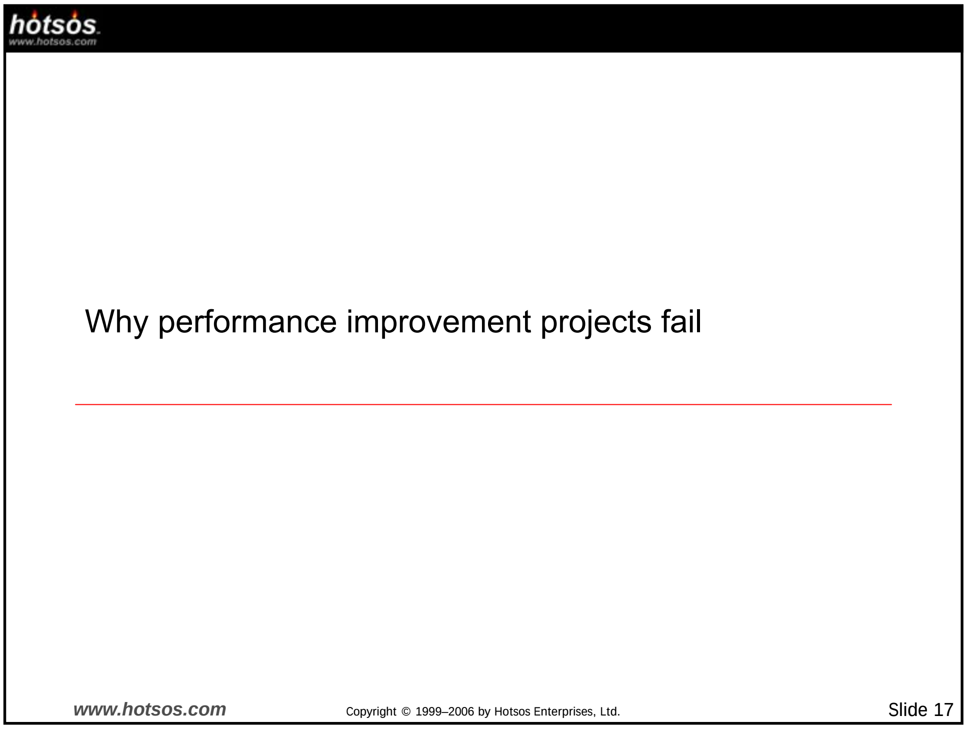

Why performance improvement projects fail

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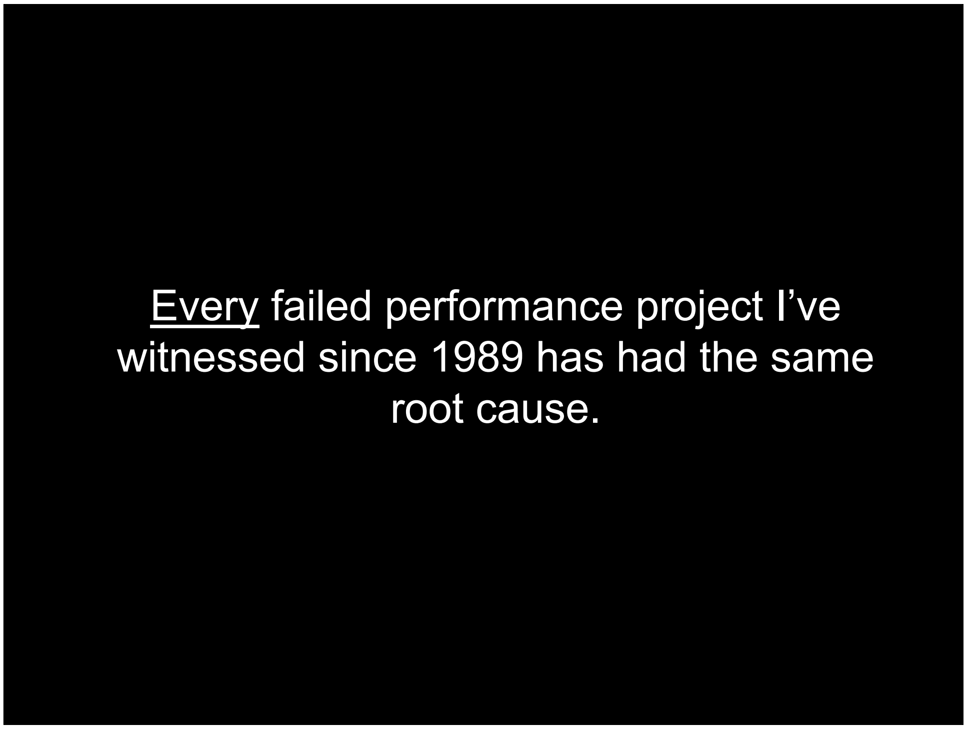
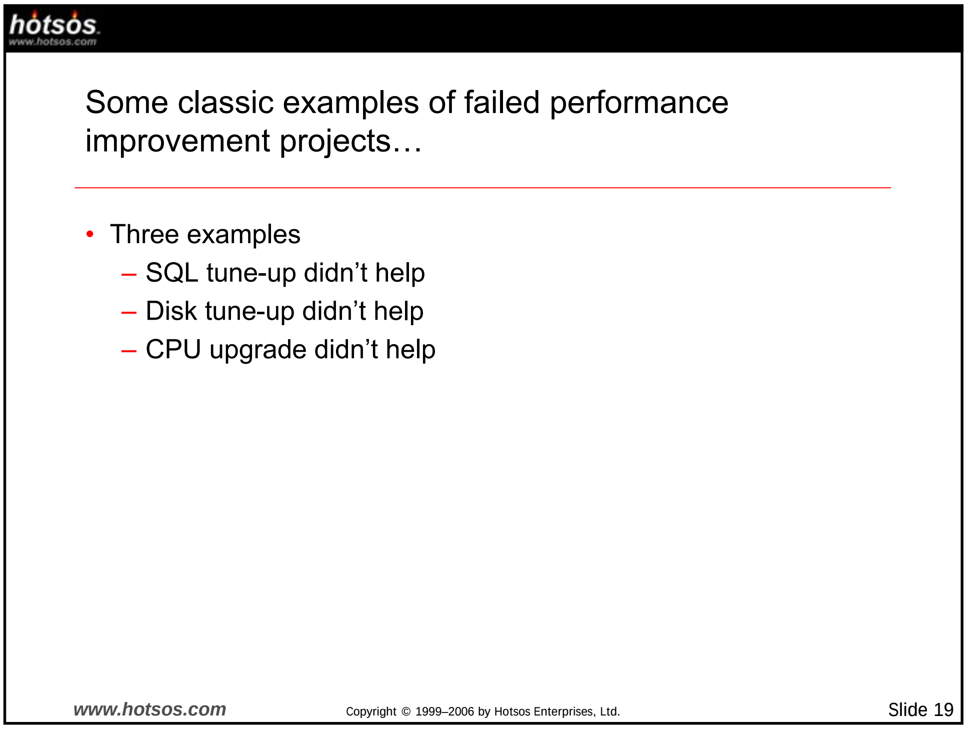


Every failed performance project I’ve witnessed since 1989 has had the same root cause.



Some classic examples of failed performance improvement projects…

- Three examples
  - SQL tune-up didn't help
  - Disk tune-up didn't help
  - CPU upgrade didn't help

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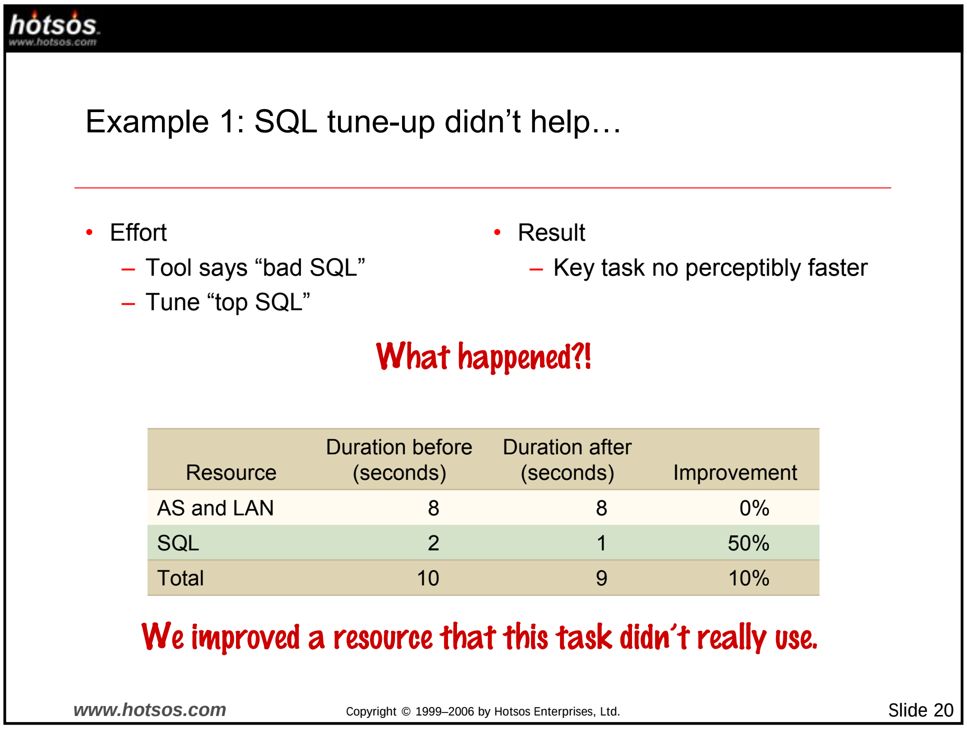

Example 1: SQL tune-up didn't help…

- Effort
  - Tool says "bad SQL"
  - Tune "top SQL"
- Result
  - Key task no perceptibly faster

What happened?!

Resource	Duration before (seconds)	Duration after (seconds)	Improvement
AS and LAN	8	8	0%
SQL	2	1	50%
Total	10	9	10%

We improved a resource that this task didn't really use.

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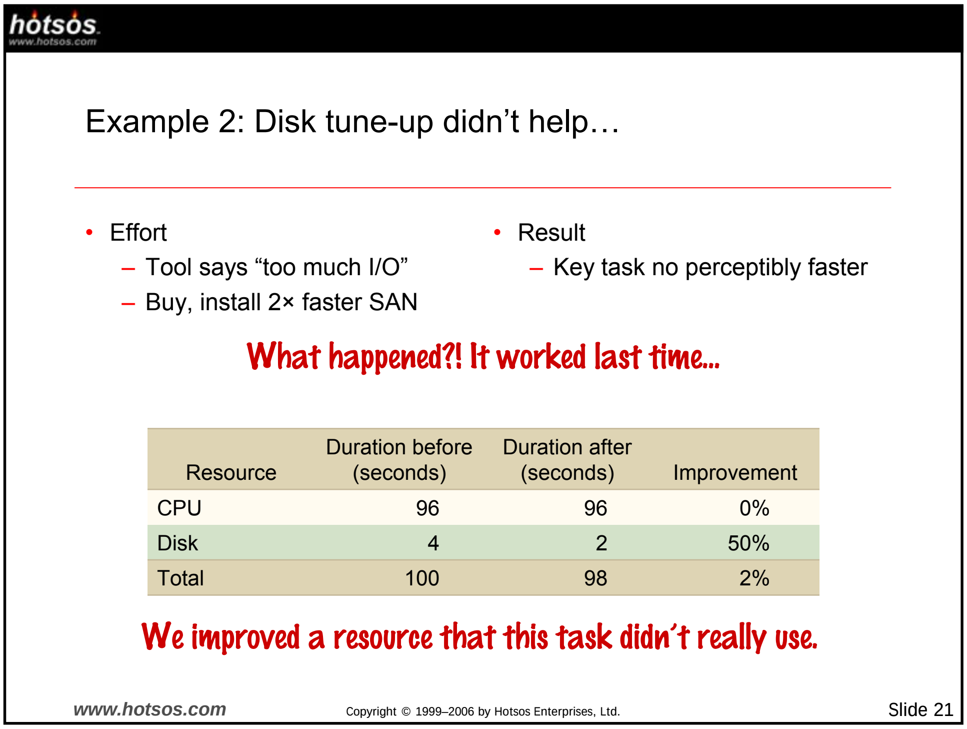

Example 2: Disk tune-up didn't help…

- Effort
  - Tool says "too much I/O"
  - Buy, install 2× faster SAN
- Result
  - Key task no perceptibly faster

What happened?! It worked last time…

Resource	Duration before (seconds)	Duration after (seconds)	Improvement
CPU	96	96	0%
Disk	4	2	50%
Total	100	98	2%

We improved a resource that this task didn't really use.

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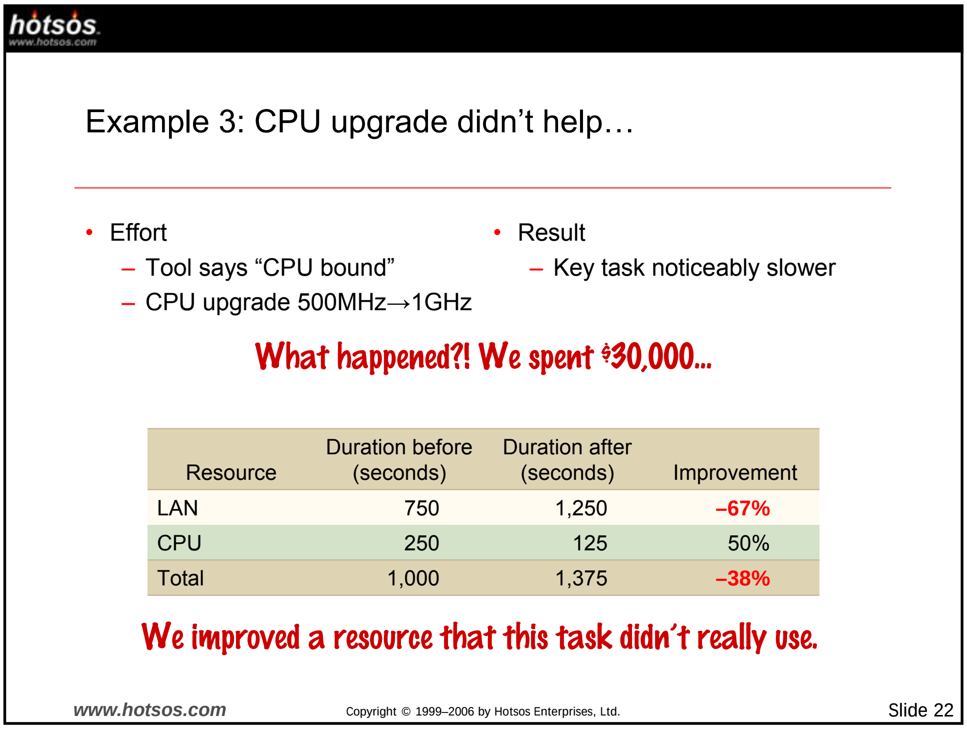

Example 3: CPU upgrade didn't help…

- Effort
  - Tool says "CPU bound"
  - CPU upgrade 500MHz→1GHz
- Result
  - Key task noticeably slower

What happened?! We spent $30,000…

Resource	Duration before (seconds)	Duration after (seconds)	Improvement
LAN	750	1,250	**–67%**
CPU	250	125	50%
Total	1,000	1,375	**–38%**

We improved a resource that this task didn't really use.

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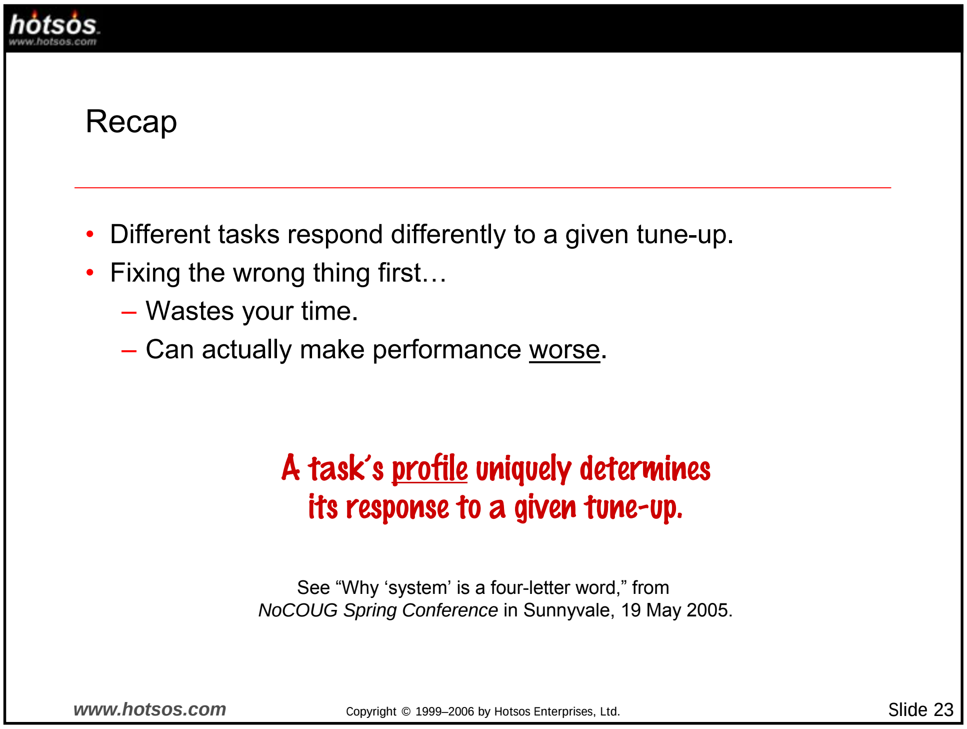

Recap

- Different tasks respond differently to a given tune-up.
- Fixing the wrong thing first…
  - Wastes your time.
  - Can actually make performance worse.

A task's profile uniquely determines its response to a given tune-up.

See "Why 'system' is a four-letter word," from
NoCOUG Spring Conference in Sunnyvale, 19 May 2005.

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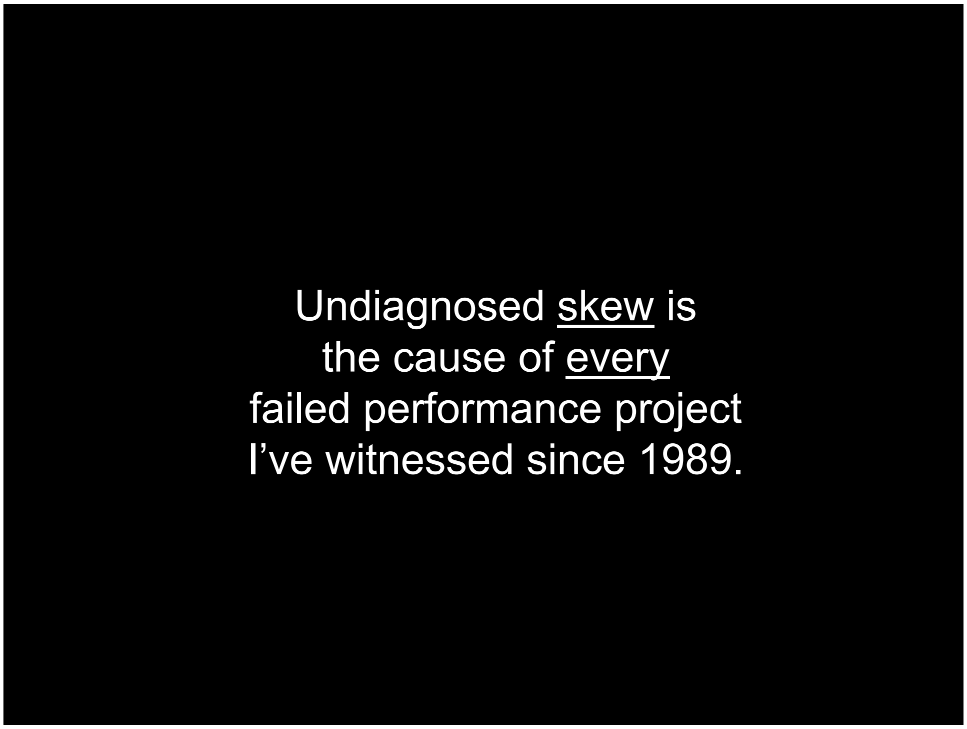

Undiagnosed skew is
the cause of every
failed performance project
I've witnessed since 1989.

Skew in diagnostic data

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What is skew?

- Imagine…
  - You’re in a group of 1,000 people
  - You get “any kind of ice cream you want”
  - You want orange (in fact, you’re allergic to chocolate)
  - 1,000 people surveyed: 999 want chocolate
  - So you get chocolate
  - How happy are you?

Provider’s measurement: 99.9% happiness rate.

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What is skew?

- Skew is a non-uniformity in your data
  - The “red rock problem” [Millsap and Holt (2003), p8]

- Examples of lists with Σ = 10, *n* = 5…

– 2, 2, 2, 2, 2	no skew
– 2, 2, 3, 1, 2	low skew
– 0, 0, 10, 0, 0	high skew

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Skew can trick you any time you assume uniformity in a list without proving it first.

System = list of tasks

Task = list of resource consumptions

Resource consumption = list of calls (e.g., to DB or OS)

Call = list of instructions

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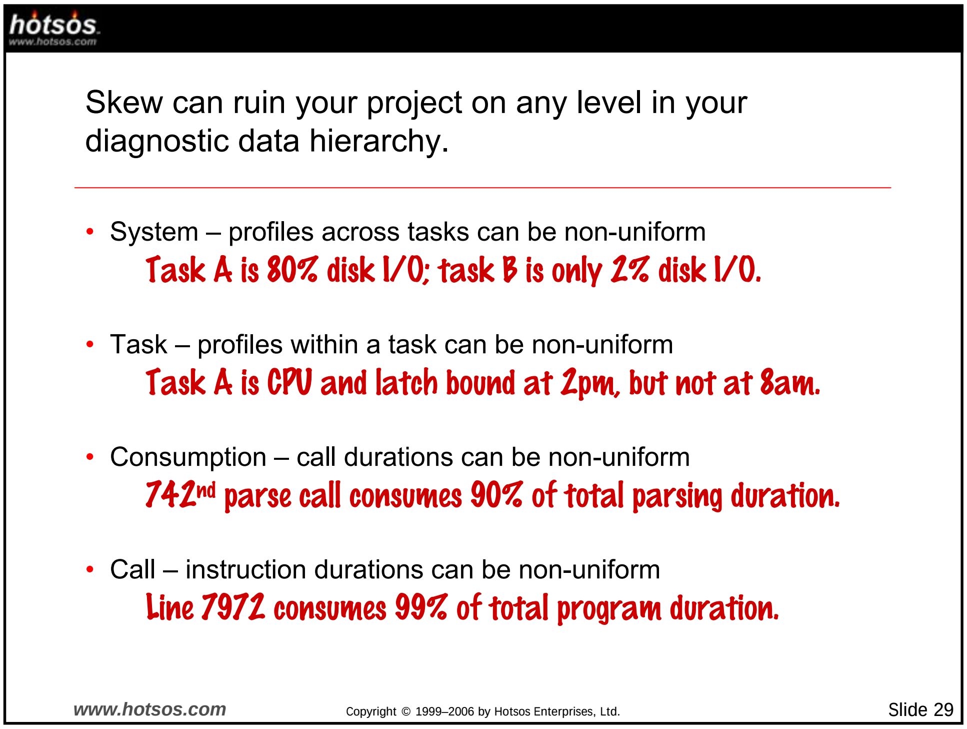

Skew can ruin your project on any level in your diagnostic data hierarchy.

- System – profiles across tasks can be non-uniform

  Task A is 80% disk I/O; task B is only 2% disk I/O.

- Task – profiles within a task can be non-uniform

  Task A is CPU and latch bound at 2pm, but not at 8am.

- Consumption – call durations can be non-uniform

  742nd parse call consumes 90% of total parsing duration.

- Call – instruction durations can be non-uniform

  Line 7972 consumes 99% of total program duration.

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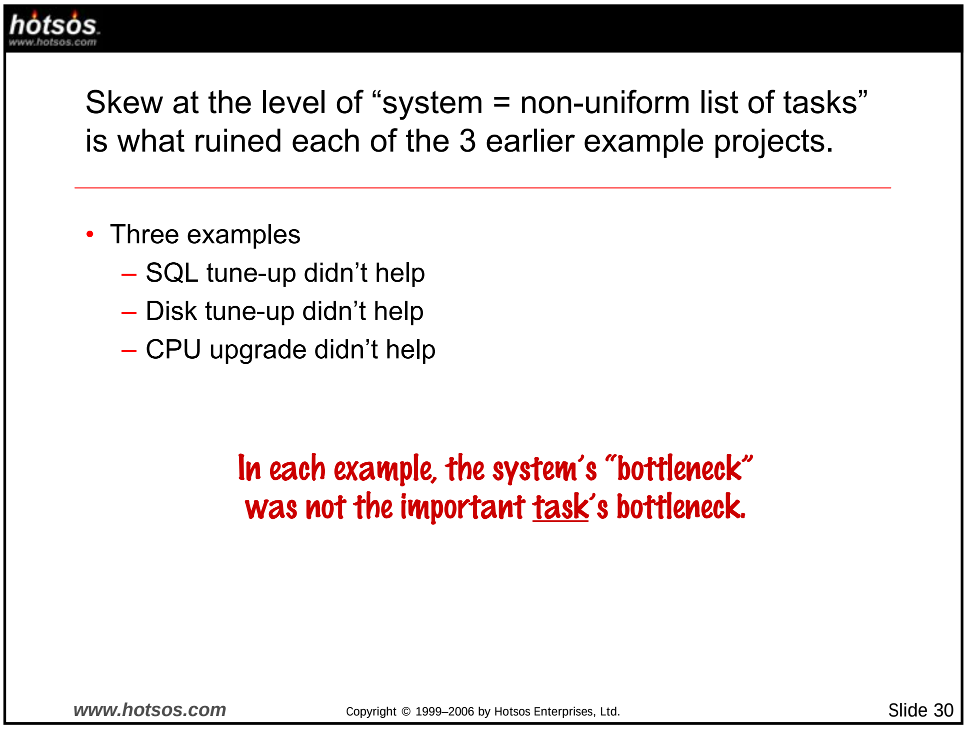

Skew at the level of “system = non-uniform list of tasks” is what ruined each of the 3 earlier example projects.

- Three examples
  - SQL tune-up didn’t help
  - Disk tune-up didn’t help
  - CPU upgrade didn’t help

**In each example, the system’s “bottleneck”
was not the important task’s bottleneck.**

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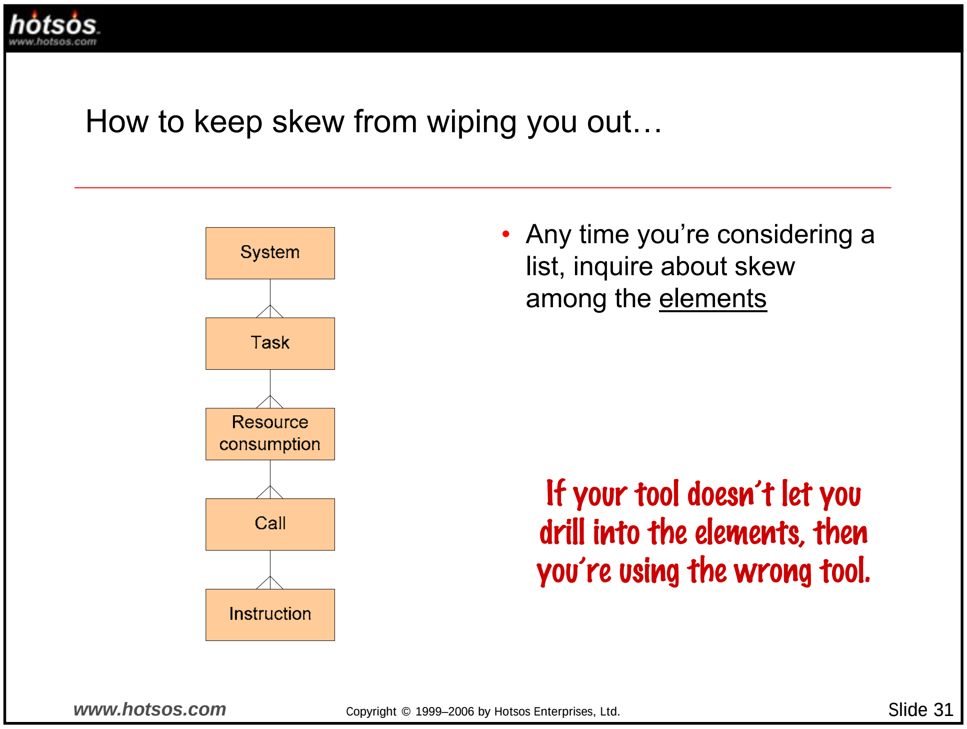

How to keep skew from wiping you out…

System

Task

Resource consumption

Call

Instruction

- Any time you're considering a list, inquire about skew among the elements

If your tool doesn't let you drill into the elements, then you're using the wrong tool.

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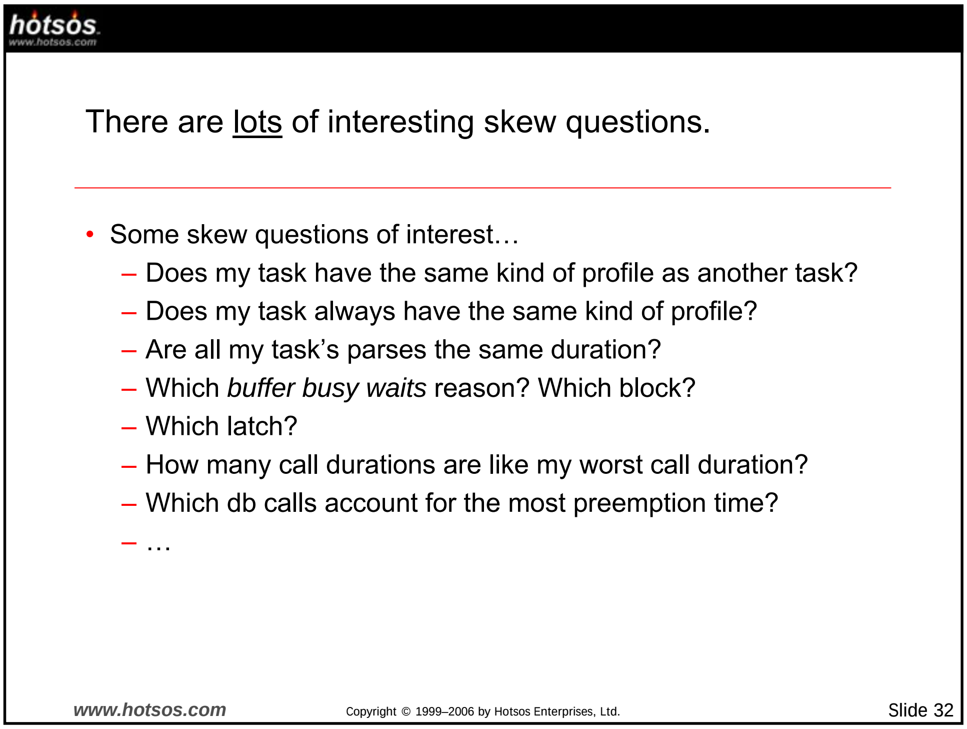

There are lots of interesting skew questions.

- Some skew questions of interest…
  - Does my task have the same kind of profile as another task?
  - Does my task always have the same kind of profile?
  - Are all my task's parses the same duration?
  - Which *buffer busy waits* reason? Which block?
  - Which latch?
  - How many call durations are like my worst call duration?
  - Which db calls account for the most preemption time?
  - …

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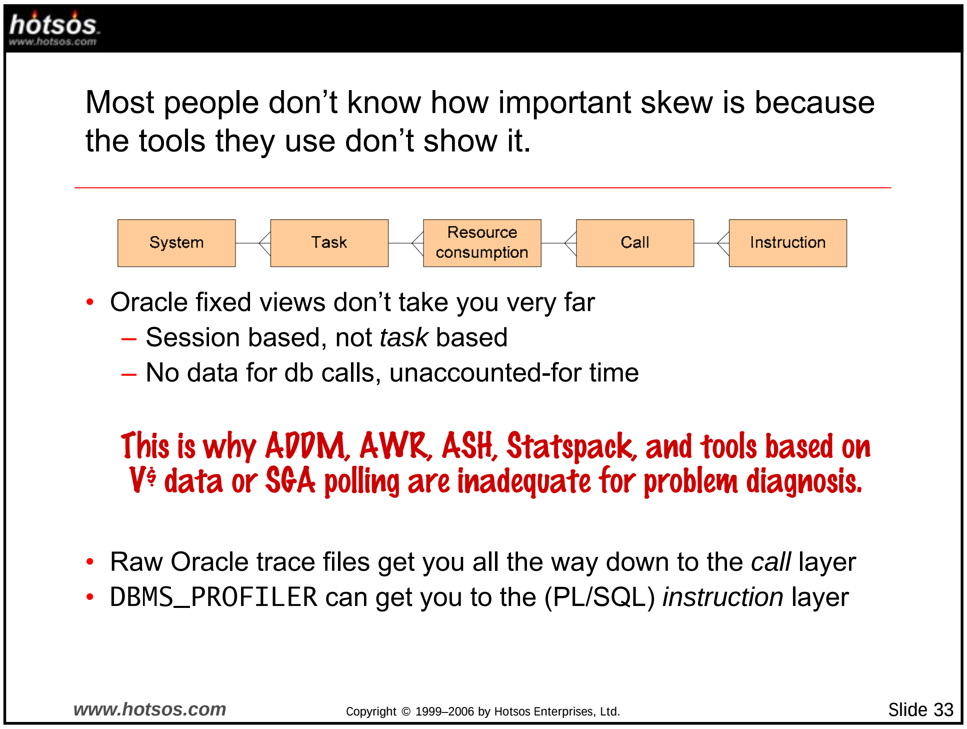

Most people don’t know how important skew is because the tools they use don’t show it.

System — Task — Resource consumption — Call — Instruction

- Oracle fixed views don’t take you very far
  - Session based, not *task* based
  - No data for db calls, unaccounted-for time

This is why ADDM, AWR, ASH, Statspack, and tools based on V$ data or SGA polling are inadequate for problem diagnosis.

- Raw Oracle trace files get you all the way down to the *call* layer
- `DBMS_PROFILER` can get you to the (PL/SQL) *instruction* layer

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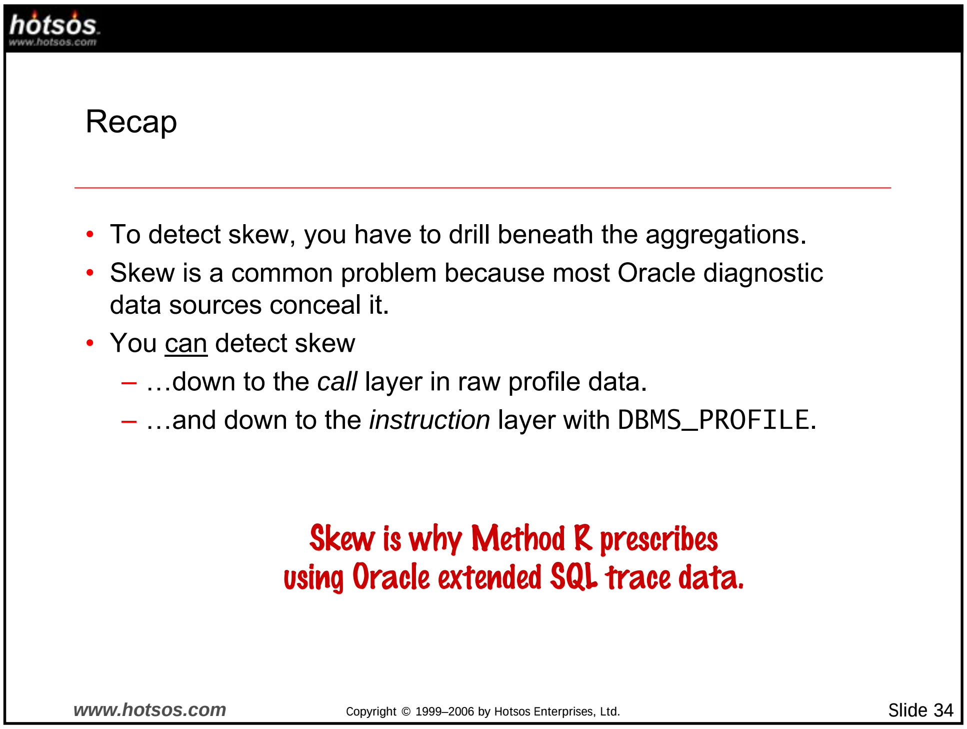

Recap

- To detect skew, you have to drill beneath the aggregations.
- Skew is a common problem because most Oracle diagnostic data sources conceal it.
- You can detect skew
  - …down to the *call* layer in raw profile data.
  - …and down to the *instruction* layer with `DBMS_PROFILE`.

Skew is why Method R prescribes using Oracle extended SQL trace data.

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The whole story in under a minute…

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You probably use aggregated data all the time

in routine operational maintenance.

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But you can’t detect skew in

aggregated diagnostic data.

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And skew can wipe out

your diagnosis and repair project.

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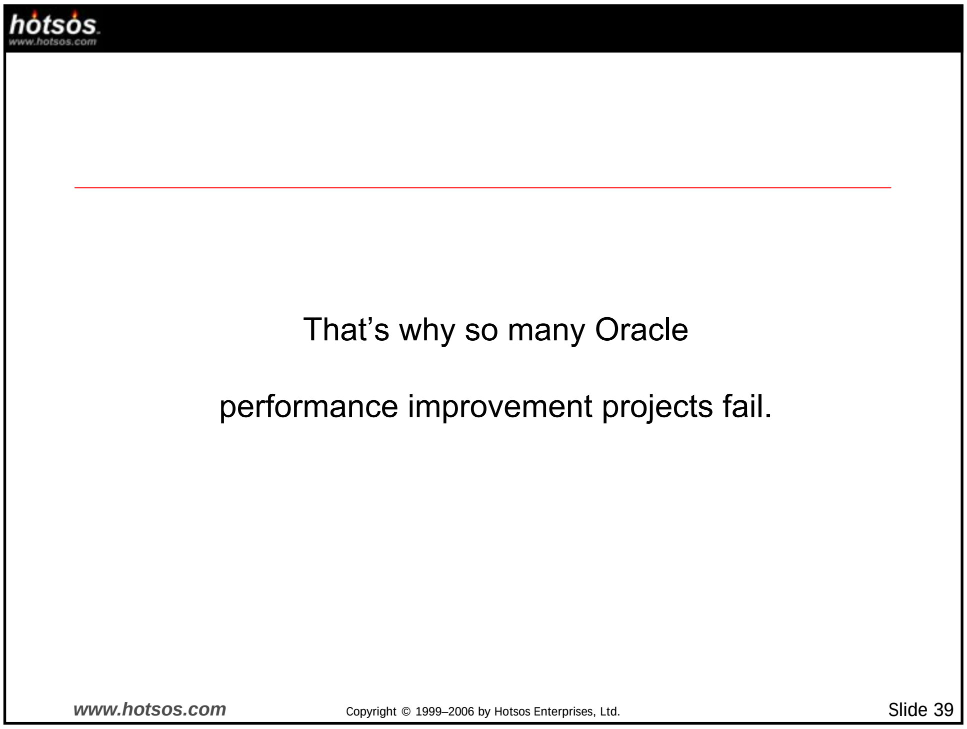

That’s why so many Oracle performance improvement projects fail.

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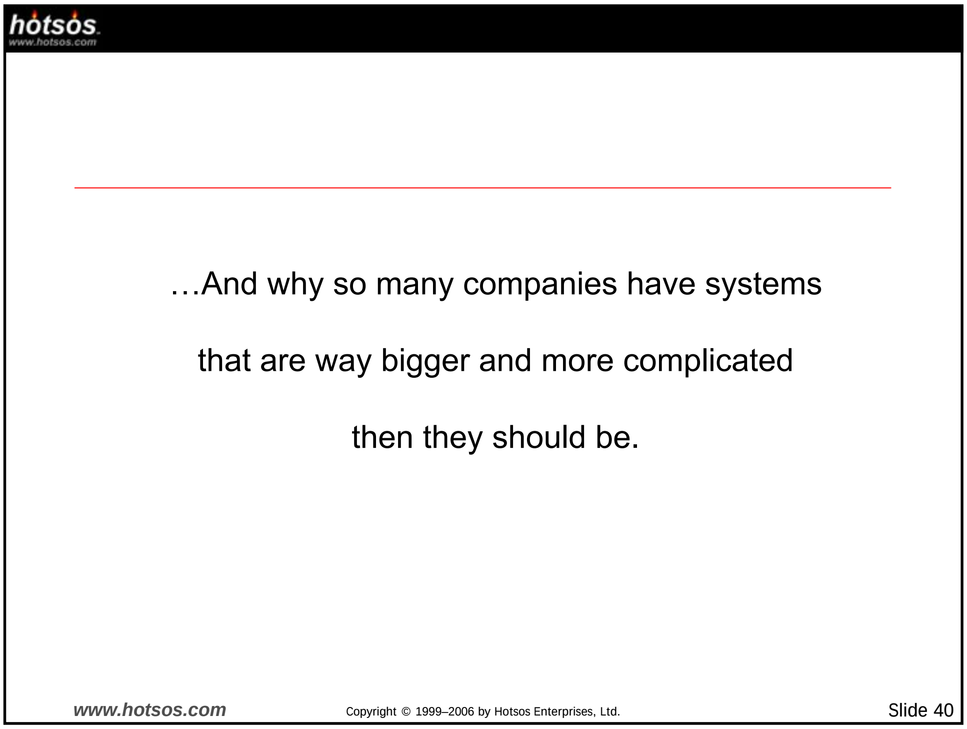

…And why so many companies have systems that are way bigger and more complicated then they should be.

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When you’re diagnosing a performance problem,

you need to focus on task response times.

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…And you need to drill down to see exactly

where the time went.

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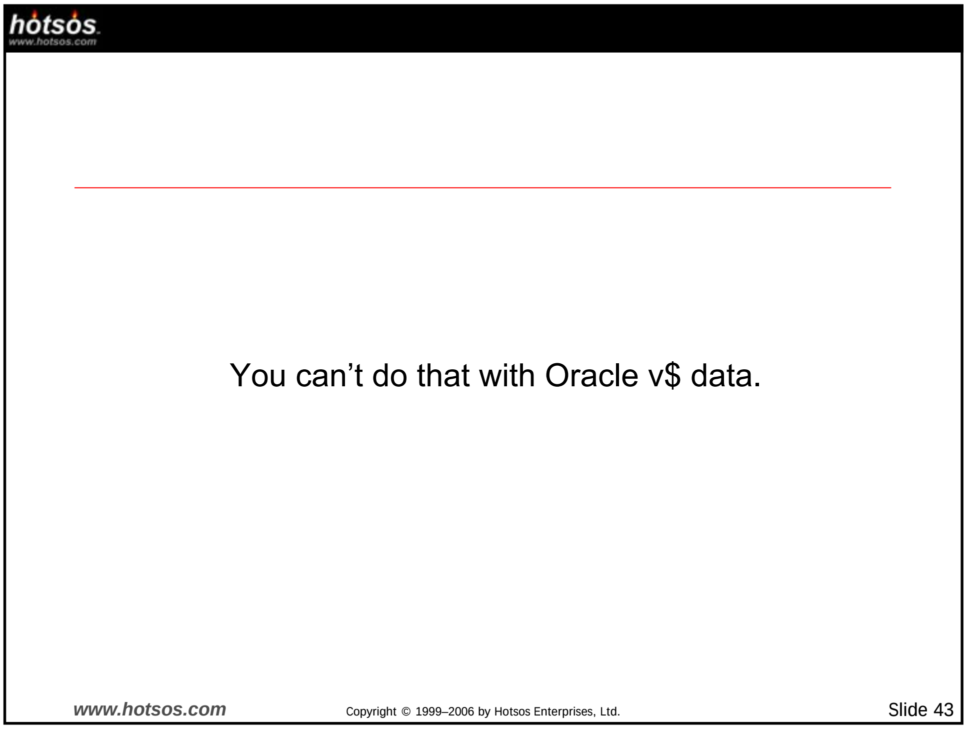

You can’t do that with Oracle v$ data.

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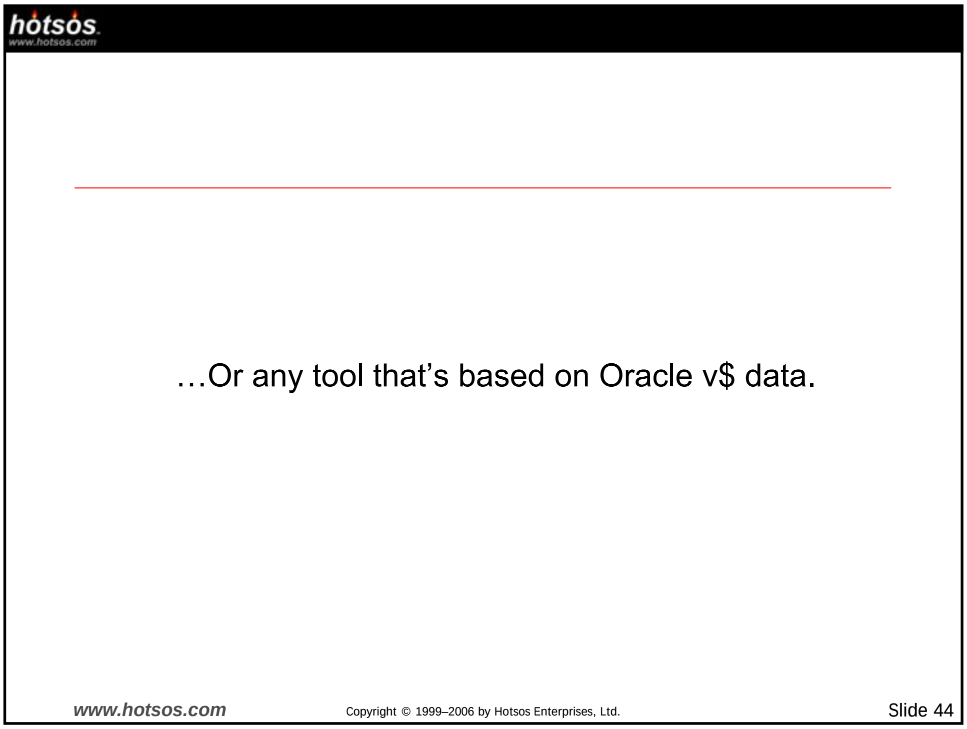

…Or any tool that’s based on Oracle v$ data.

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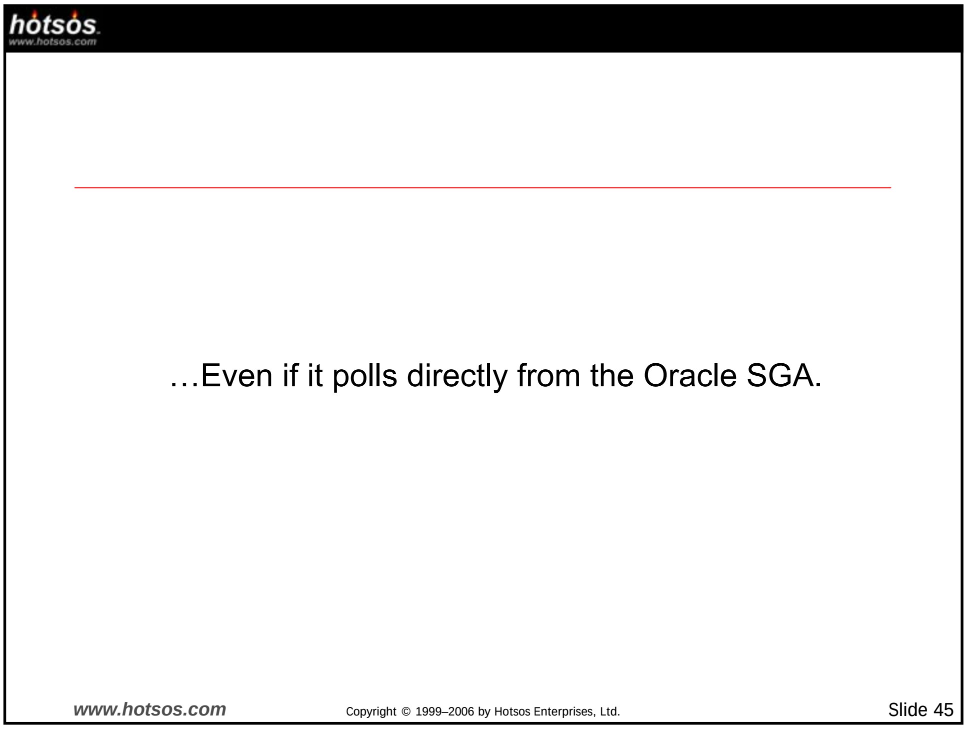

…Even if it polls directly from the Oracle SGA.

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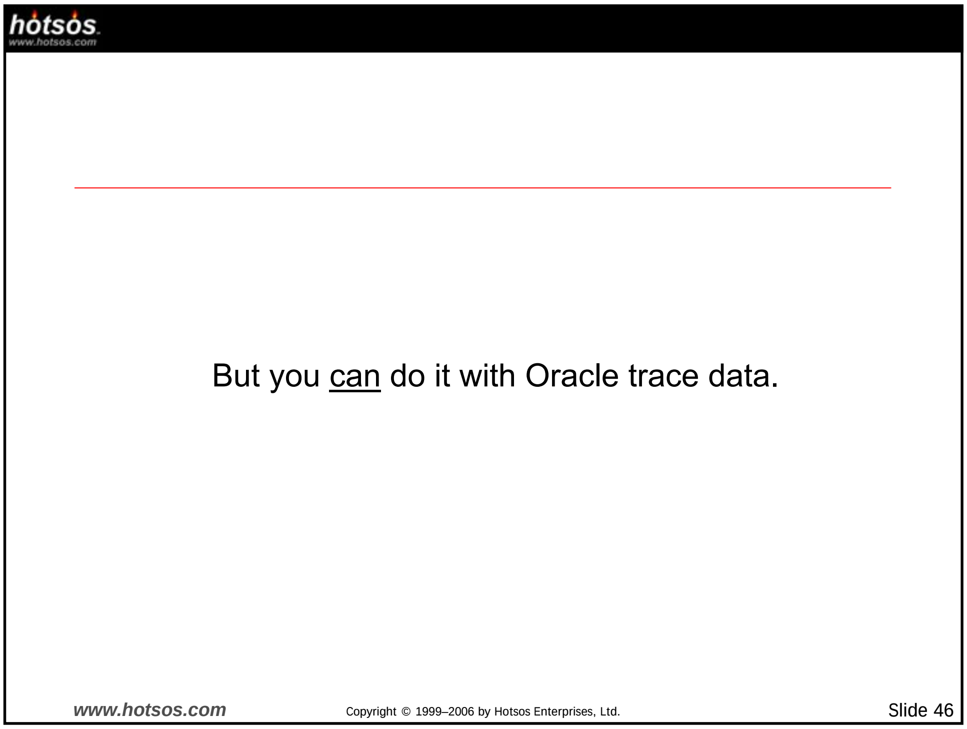

But you <u>can</u> do it with Oracle trace data.

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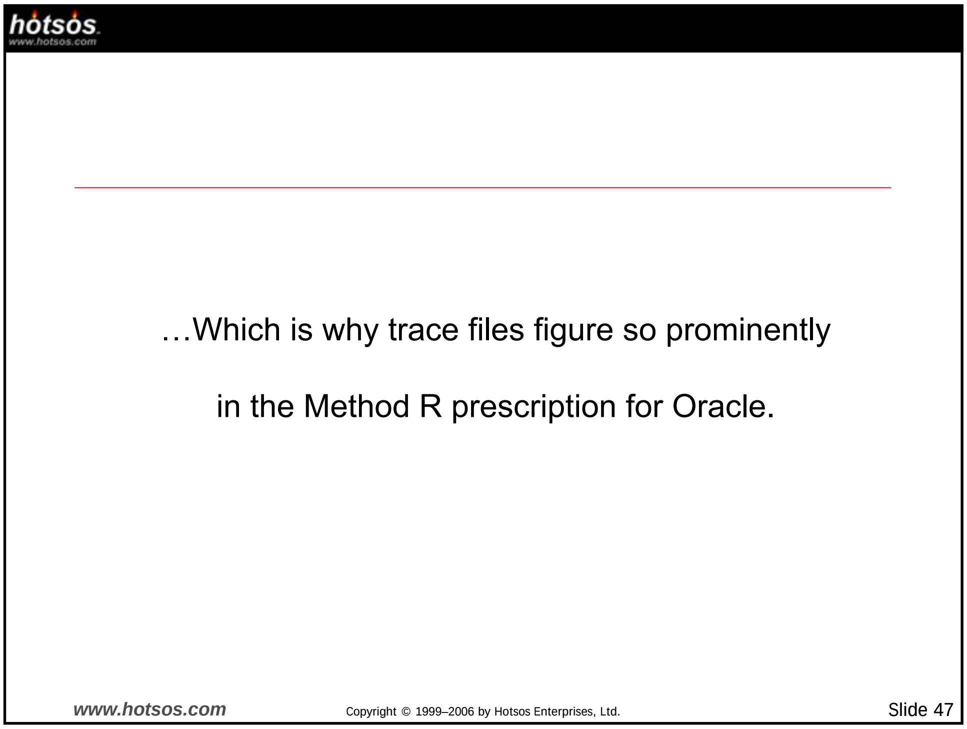

…Which is why trace files figure so prominently

in the Method R prescription for Oracle.

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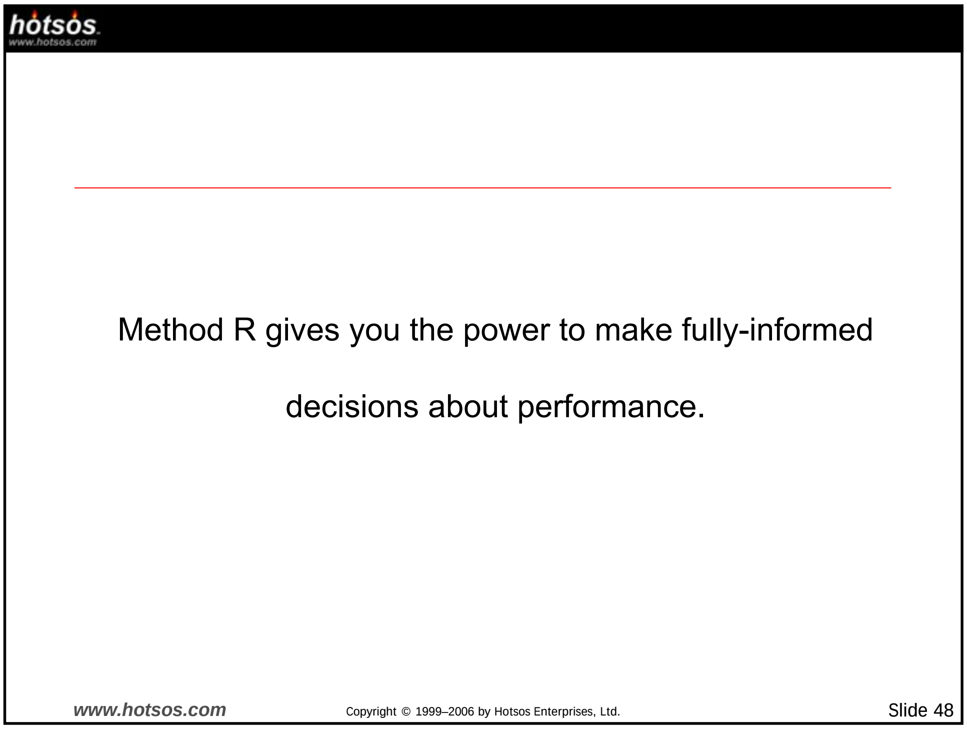

Method R gives you the power to make fully-informed

decisions about performance.

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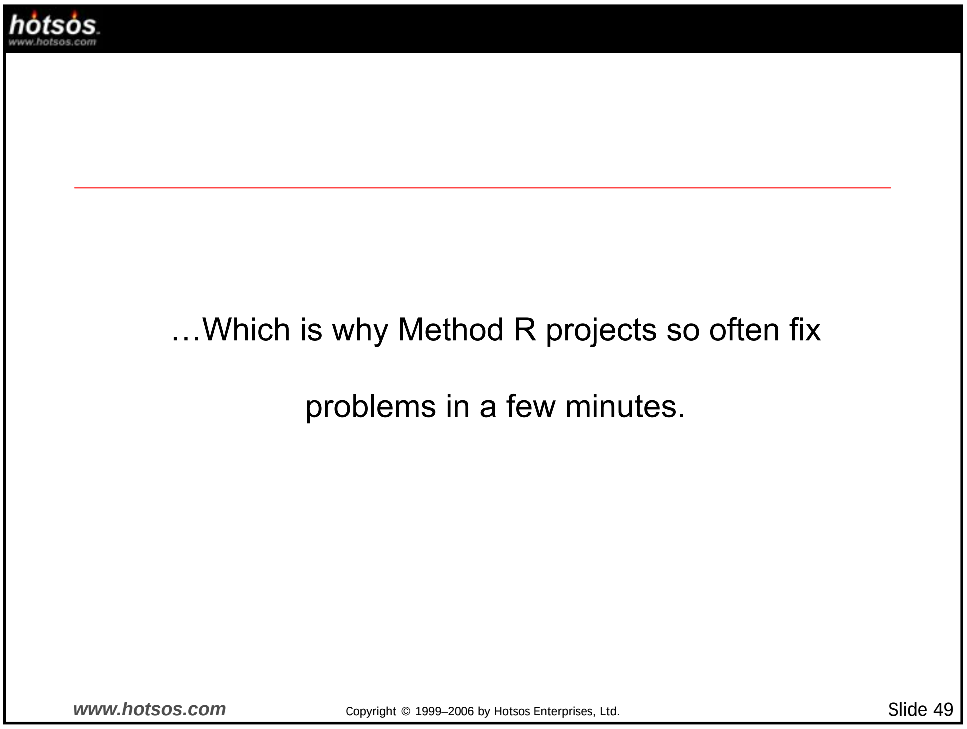

…Which is why Method R projects so often fix problems in a few minutes.

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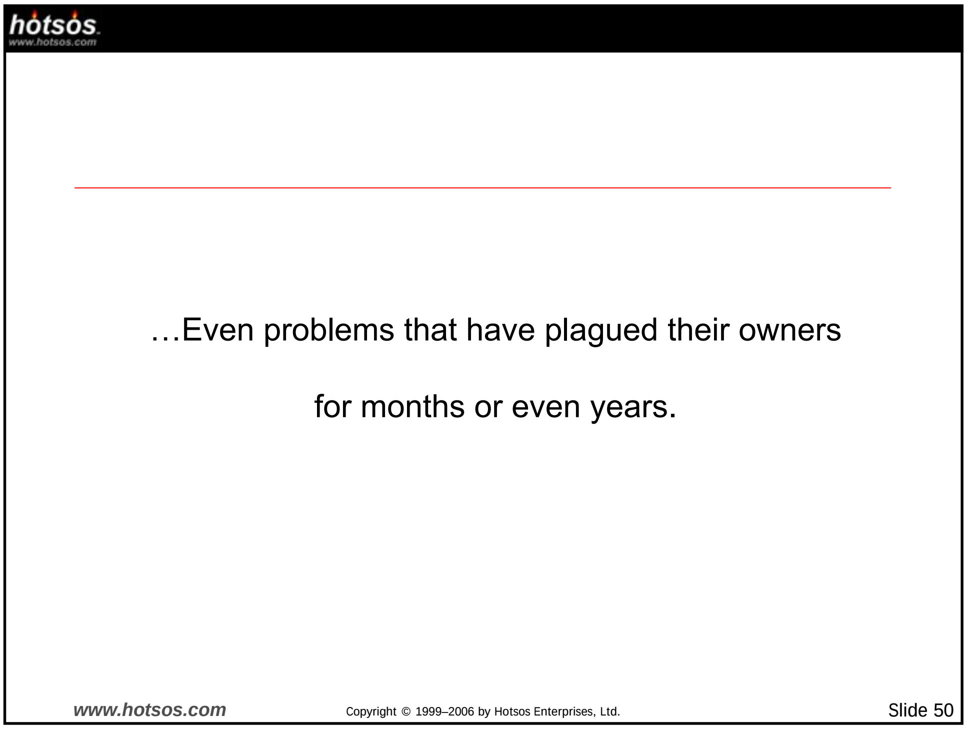

…Even problems that have plagued their owners for months or even years.

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Thank you

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