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## **The Best Way...**

Thomas Kyte  
<http://asktom.oracle.com/>

**What we know, shapes how we do things...**

```
ops$tkyte%ORA11GR1> with
 2  players as
 3  ( select cast( 'P' || rownum as varchar2(2) ) username
 4      from all_objects
 5      where rownum <= 8 ),
 6  weeks as
 7  ( select rownum week
 8      from all_objects
 9      where rownum <= 7 ),
10  data as
11  ( select username,
12         week,
13         row_number() over (partition by week order by rnd) rn
14      from ( select username, week, dbms_random.random rnd
15             from players, weeks
16             )
17  )
18  select *
19  from data
20  pivot( max(username) for rn in (1,2,3,4,5,6,7,8) )
21  order by week
22  /
```

```

ops$tkyte%ORA11GR1> with
 2  players as
 3  ( select cast( 'P' || rownum as varchar2(2) ) username
 4      from all_objects
 5      where rownum <= 8 ),
 6  ...
18  select *
19  from data
20  pivot( max(username) for rn in (1,2,3,4,5,6,7,8) )
21  order by week
22  /

```

```

      WEEK 1  2  3  4  5  6  7  8
----- -- -- -- -- -- -- -- --
      1 P4 P5 P8 P3 P2 P1 P6 P7
      2 P5 P8 P7 P2 P6 P1 P4 P3
      3 P8 P3 P6 P7 P4 P5 P2 P1
      4 P5 P2 P3 P8 P6 P1 P7 P4
      5 P6 P8 P1 P7 P5 P2 P4 P3
      6 P4 P8 P7 P6 P2 P1 P5 P3
      7 P6 P8 P2 P1 P3 P7 P4 P5

```

7 rows selected.

# Who am I

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times are East coast times (GMT-04:00)  
In the last 4 weeks, I've taken 354 new questions, read 1,530 followups, and responded to 1,139 of the followups

Hit	Subject	Last Updated	First Asked	Age
1	wrap	16 Jan 2005 1pm	02 Mar 2001 9pm	3.9 years old
2	Error Trapping - Reg	16 Jan 2005 12pm	29 Mar 2001 10pm	3.8 years old
3	lost update	16 Jan 2005 11am	21 Dec 2004 2pm	3 weeks old
4	OLTP Rollback segment planning	16 Jan 2005 11am	21 May 2000 7am	4.7 years old
5	What's your opinion about the DBA job in the future	16 Jan 2005 11am	29 Nov 2003 9pm	1.1 years old
6	any performance hit using sequence with nocache in OLTP	16 Jan 2005 11am	08 Nov 2002 1pm	2.2 years old
7	Full outer join in 8i	16 Jan 2005 11am	16 Jan 2003 10pm	2 years old
8	Delete Conflict Resolution	16 Jan 2005 11am	19 Oct 2000 3pm	4.2 years old
9	Loading Lobs Using SQL Loader	16 Jan 2005 11am	23 Aug 2000 4pm	4.4 years old
10	data files	16 Jan 2005 11am	03 Nov 2003 8am	1.2 years old

Submit a New Question

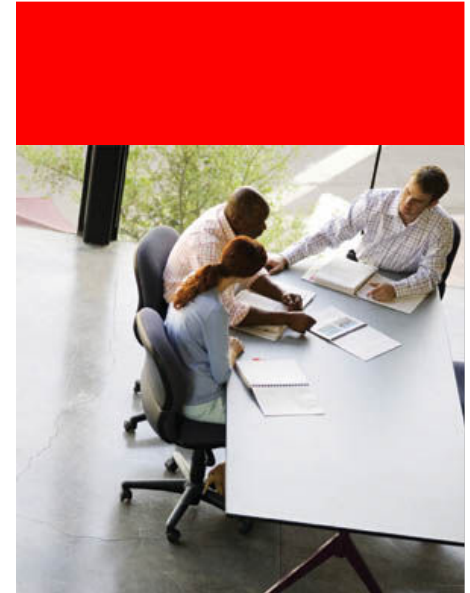
27°F Mon 27°F Tue 37°F Wed Proxy: at-home Adblock

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AT THE HELM

- Been with Oracle since 1993
- User of Oracle since 1987
- The “Tom” behind AskTom in Oracle Magazine  
*www.oracle.com/oramag*
- Expert Oracle Database Architecture
- Effective Oracle by Design
- Expert One on One Oracle
- Beginning Oracle

**New Ideas** – Almost always  
come from those uncommitted  
to the status quo – from  
outsiders

*People are committed to whatever has worked for  
them in the past.*



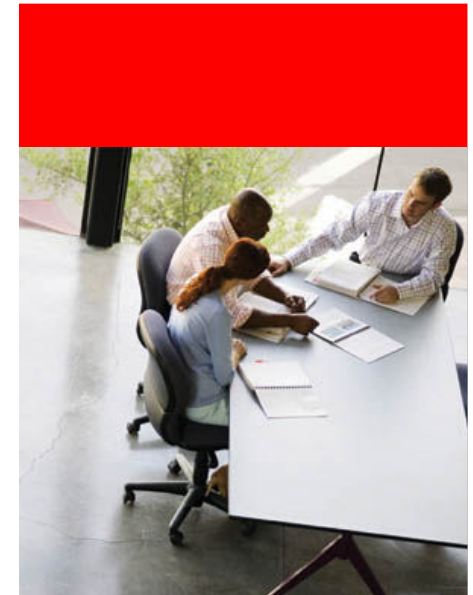
## **Best Practices defined –**

***Consensus of expert opinions, based on actual customer experiences in practice.***

***Lessons learned.***

***Proven practices associated with a particular usage profile.***

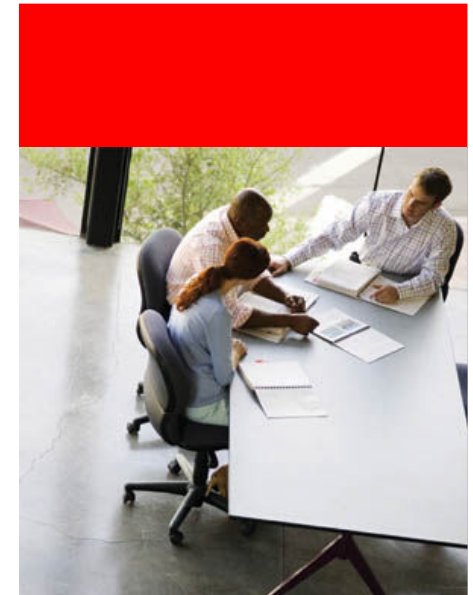
***Baseline configuration rules - prerequisite to tuning.***



**Sounds all good...**

**Best Practices** – It is easy with Best Practices to forget that once a practice has been branded as "Best", that it may **represent certain tradeoffs** and may **involve noteworthy downside potential**. It is also easy to forget the *context* for which any given practice was promoted as "Best", and therefore **apply it in some inappropriate context**.

- *Bob Sneed, Sun Microsystems*





# Bryn Llewellyn on Best Practices

*Prescribing best practice principles for programming any 3GL is phenomenally difficult. One of the hardest challenges is the safety of the assumption that the reader starts out with these qualities*

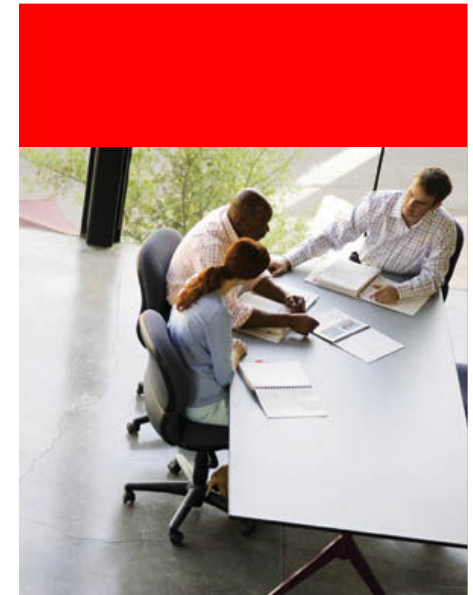
- *Required skills and abilities to begin with (Do they have a background in programming or a desire to learn it? Do they have the test specific skills and aggressive mindset that arise along the way?)*



**“What is the best way..?” –  
Questions that begin and end  
with that can drive you nuts.**

*If there was a universal best way to do something,  
we would not have implemented the other ways...*

AskTom “What is The best way?”



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**{what is the best way} Approximately 8368 records found.**

Times are East coast times (GMT-0500)  
 In the last 4 weeks, I've taken 22 new questions, read 432 followups, and responded to 331 of the followups

Search "what is the best way" Display 15 **Go** **Advanced Search**

Subject	Score ▼	Last Updated	First Asked
Separating comma separated words	40	1 Oct 2008 01:15PM	7 years ago
CURSOR	36	24 Nov 2008 11:31AM	7.9 years ago
reclaim space	32	1 Dec 2008 05:51AM	6.4 years ago
P/SQL ETL	32	4 Feb 2008 05:23PM	5.7 years ago
How to Update millions of records in			

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Is there  
a *best way*  
to do something – every  
time?

```
select *  
  from t1, t2  
 where t1. id = t2. id  
       and t1.small_distinct = :x
```

- T1 is large, where small\_distinct = :x returns much of the table
- T2 is large



Is there  
a *best way*  
to do something – every  
time?

```
select * from t1, t2
where t1. id = t2. Id and t1.small_distinct = :x
```

#### HASH JOIN

TABLE ACCESS FULL T1  
TABLE ACCESS FULL T2

#### SELECT STATEMENT

#### NESTED LOOPS

TABLE ACCESS BY INDEX ROWID(T1)  
INDEX RANGE SCAN T1\_IDX  
TABLE ACCESS BY INDEX ROWID(T2)  
INDEX UNIQUE SCAN T2\_PK



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INDEX UNIQUE SCAN T2\_PK

call	count	cpu	elapsed	disk	query
Fetch	35227	5.63	9.32	23380	59350
Fetch	35227	912.07	3440.70	1154555	121367981



Is there  
a *best way*  
to do something – every  
time?

**HASH JOIN**

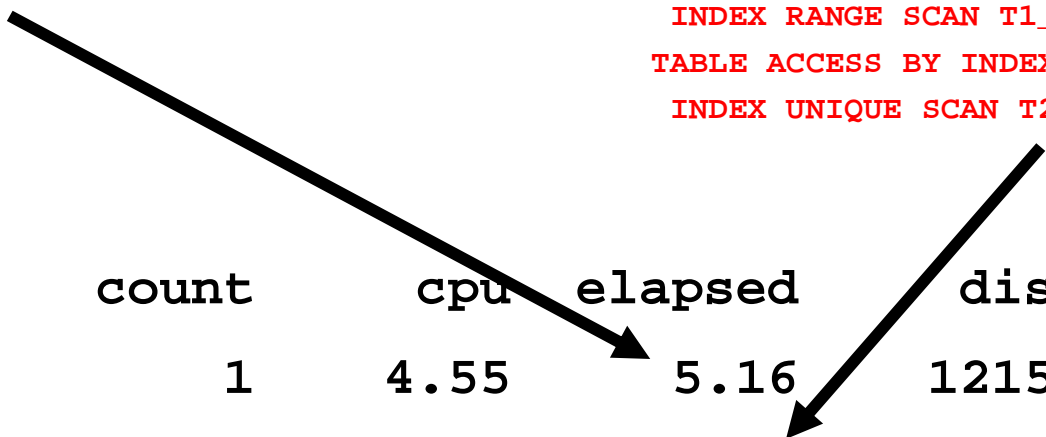
TABLE ACCESS FULL T1  
TABLE ACCESS FULL T2

**SELECT STATEMENT**

**NESTED LOOPS**

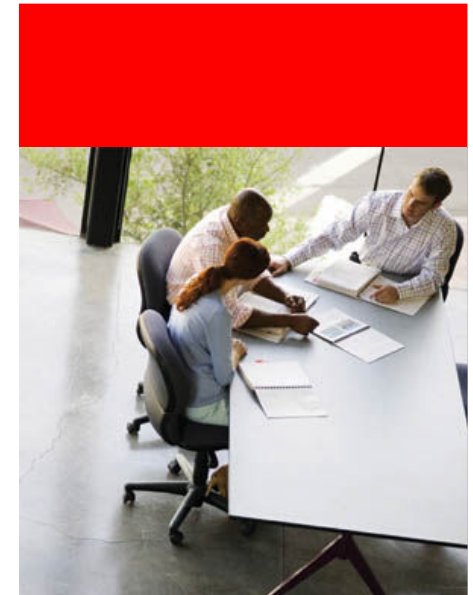
TABLE ACCESS BY INDEX ROWID(T1)  
INDEX RANGE SCAN T1\_IDX  
TABLE ACCESS BY INDEX ROWID(T2)  
INDEX UNIQUE SCAN T2\_PK

call	count	cpu	elapsed	disk	query
Fetch	1	4.55	5.16	12152	12456
Fetch	1	0.05	0.09	12	15



**It takes a context – It is also easy to forget the *context* for which any given practice was promoted as "Best", and therefore apply it in *some inappropriate context***

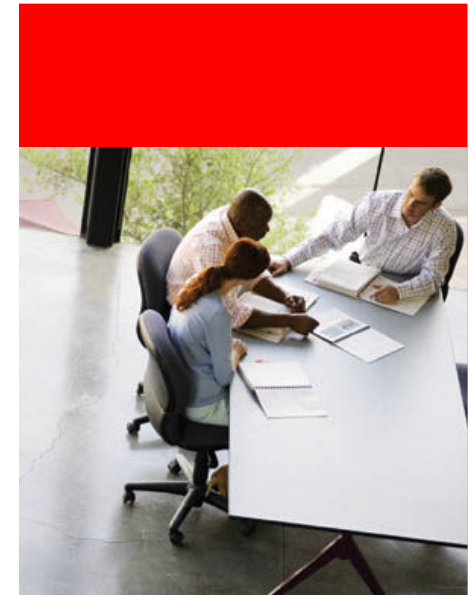
*Indexes are 'best', everyone knows that...*



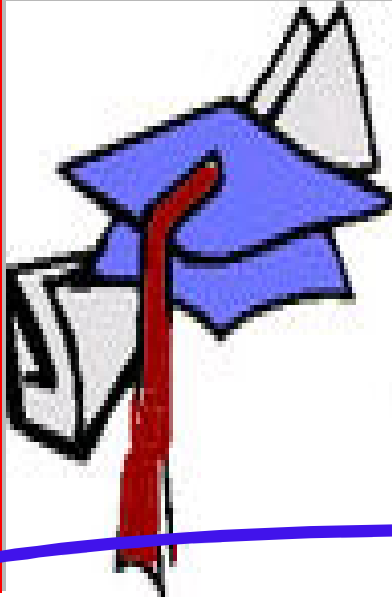


**It takes understanding too –**  
***You need to take the facts,***  
***coupled with your knowledge,***

*How do I tune with tkprof...*







What can  
you do with this  
information?

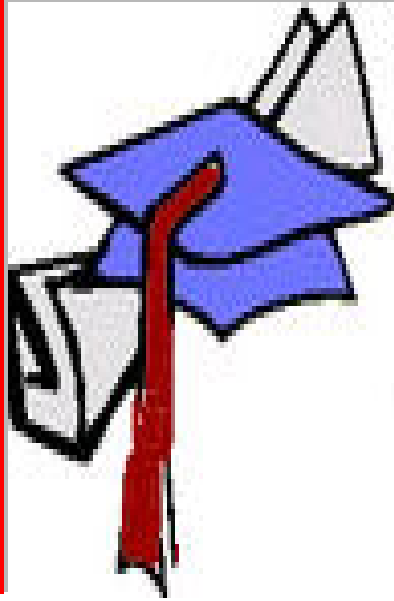
```
select count(subobject_name) from big_table.big_table
```

```
COUNT(SUBOBJECT_NAME)  
-----  
688858
```

call	count	cpu	elapsed	disk	query
total	4	99.36	262.11	1840758	1840800

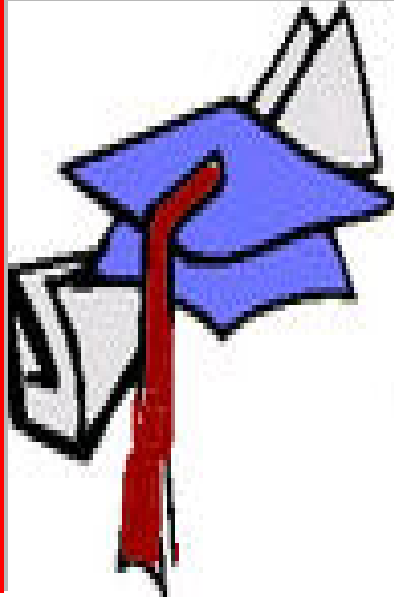
Rows	Row Source	Operation
1	SORT AGGREGATE	(cr=1840797 pr=1840758 pw=0 time=262104893 us)
128000000	TABLE ACCESS FULL	BIG TABLE (cr=1840797 pr=1840758 pw=0 time=384004887 us)

Event waited on	Times	Max. Wait	Total Waited
db file scattered read	14425	0.22	195.87



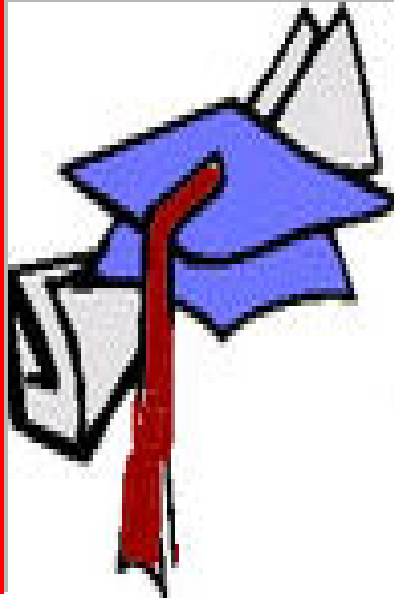
**First, there  
are a bunch of  
*facts...***

- Query took a long time – *if we make it fast...*
- We did a ton of physical IO – *and that is slow*
- We did a ton of logical IO – *and that is not 'free'*
- There is a big difference between elapsed and cpu – *we were waiting for something*
- We can see our query and plan – *we know the answer to the query*



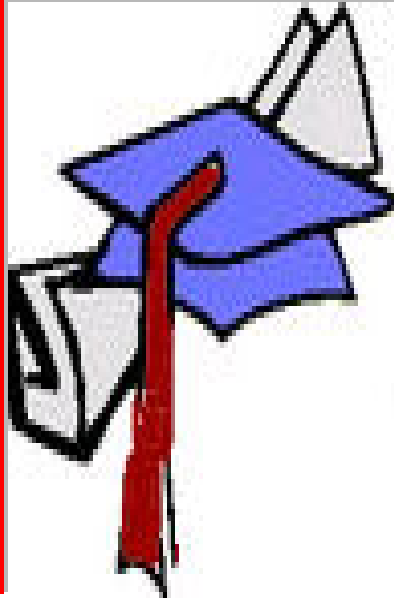
**There are  
things we have  
knowledge of...**

- We know the data (it is ours after all)
- How Oracle works (hopefully!)



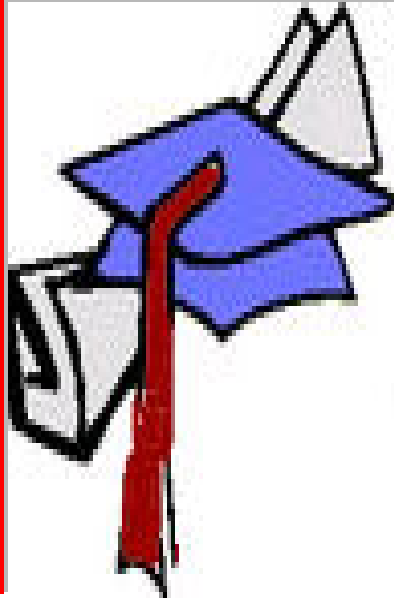
**What are  
some obvious  
things to think  
about here?**

- We needed a very small subset of the rows – 700k out of 128m
- The table looks well packed – simple math, divide IO's (cr=1,840,797) by rows (128,000,000), about 70 rows/block and given we know the average row width (it is our data after all...) that sounds nicely packed
  - What can we rule out now? Shrink and Rebuild...



## What are Some possible options?

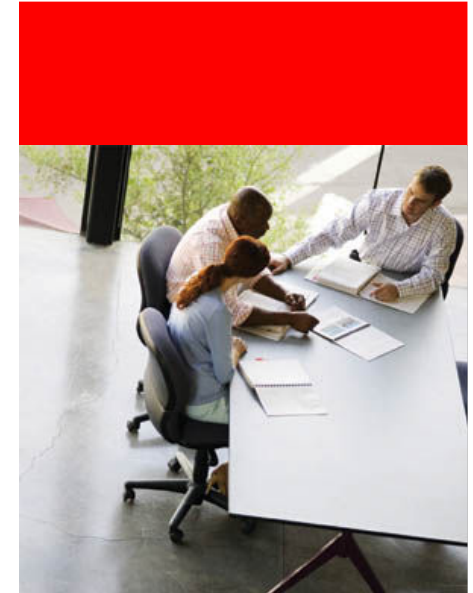
- Make full scan faster
  - Maybe by compressing the table
  - Maybe by including subobject\_name in some index (to avoid the table)
- Remove Full Scan
  - We are interested in only 0.6% of the data
  - Maybe a new index would help
- Don't do it or do it differently...



**In Real  
Life it  
Will be more  
*Complex...***

- It will be more complex in general
- But the process is the same
  - Get *facts*
  - *Infer* more facts
  - Build your *context!*
  - Rule things *out*
    - Ruling something out is as good as ruling something in
    - Many best practices will fall by the wayside here

# **Educated Incapacity – A barrier to creative ideas can be experience, ‘the best way’**

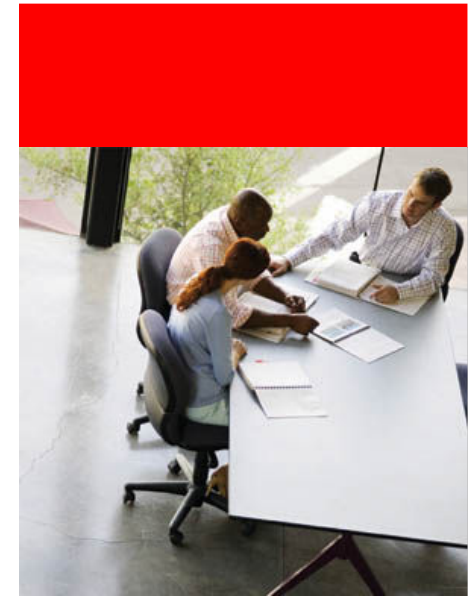


***"This 'telephone' has too many shortcomings to be seriously considered as a means of communication. The device is inherently of no value to us." – Western Union internal memo, 1876.***

***" The concept is interesting and well-formed, but in order to earn better than a 'C,' the idea must be feasible." – Yale University management professor in response to Fred Smith's paper proposing reliable overnight delivery service. Smith went on to found Federal Express Corp.***

***Although experience is often valuable, it can be a liability in a search for creative ideas.***

**So, What is the point?**



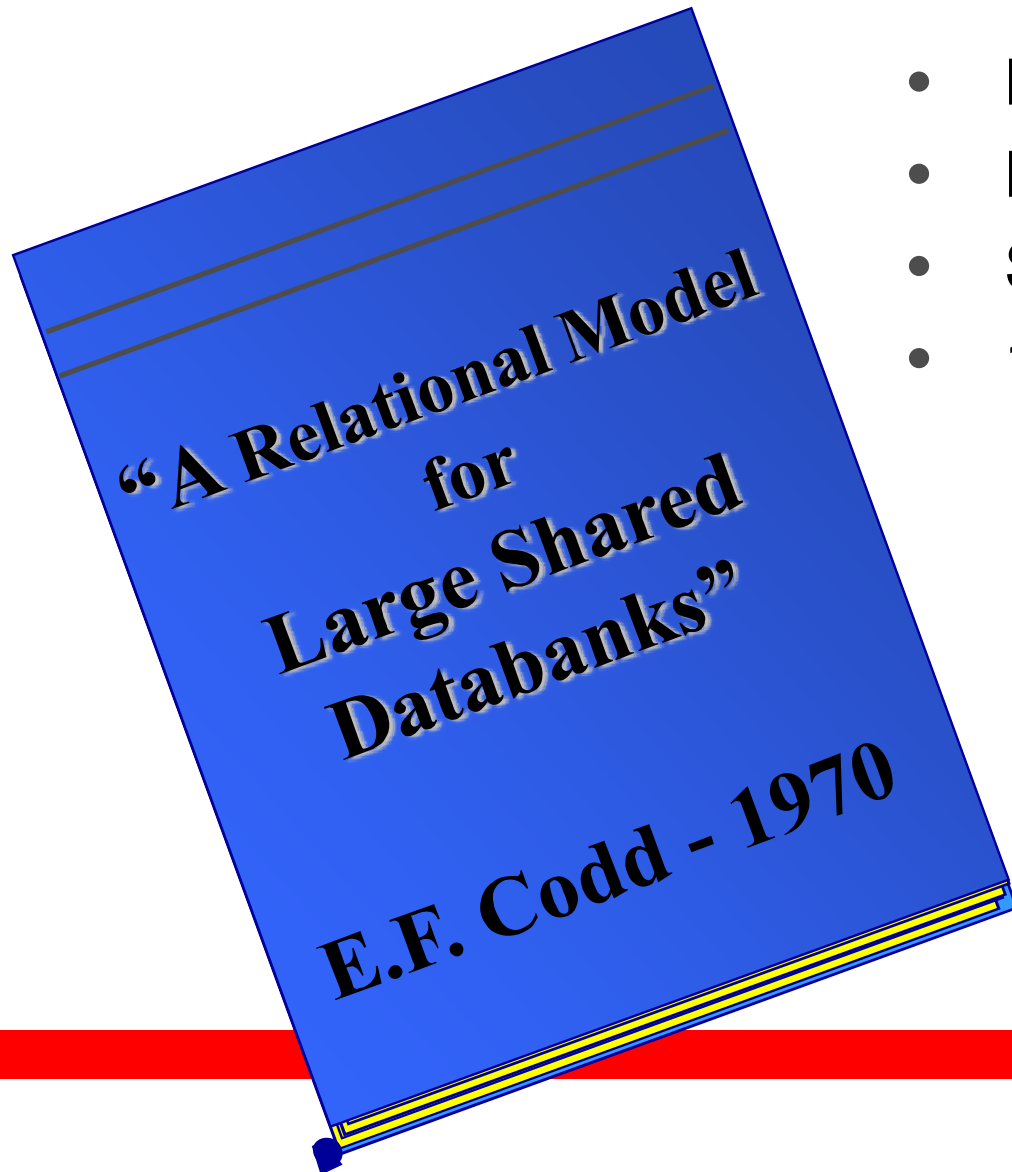




## **The Beginning...**

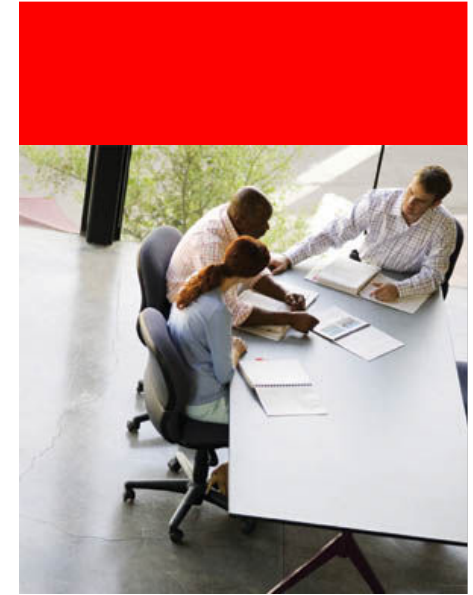
**When you were 12,  
did you know what  
you wanted to be  
when you grew up?**

# The Beginning...

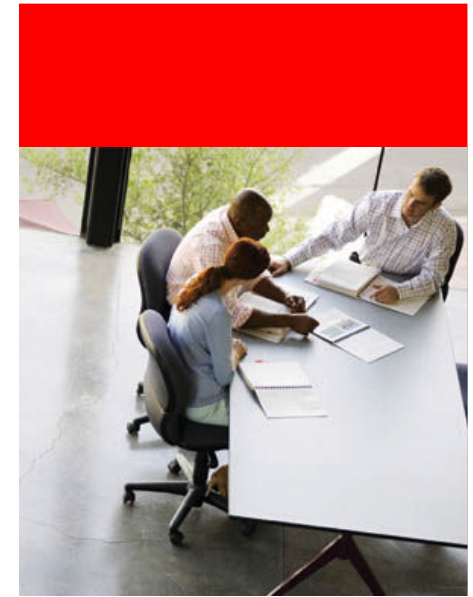


- Data Model with Structure
- Data Independent of Code
- Set-oriented
- 1977 the work begins

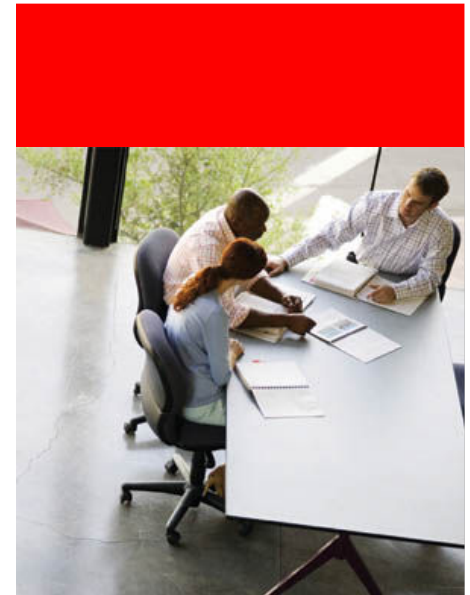
# Continuous Rethinking



# Continuous Change



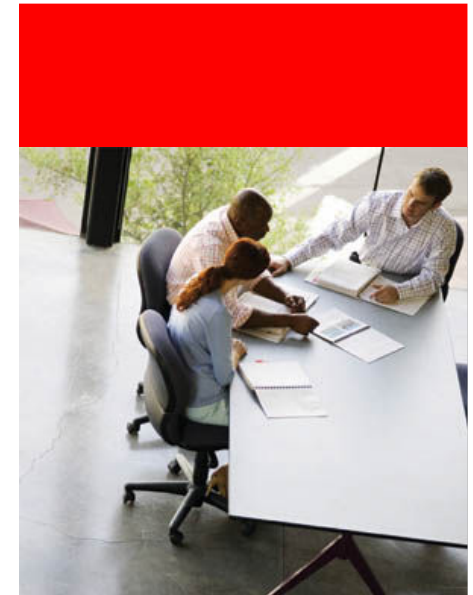
**Learn a new language – else  
everything will look like a nail.**



***C, C++, PL/I, Rexx, Exec, JCL, SAS, Pascal,  
Cobol, Java, Ada, PL/SQL, T-SQL, Prolog,  
Lisp, Scheme, Various Assemblers, many SQL  
dialects, many scripting languages, ...***

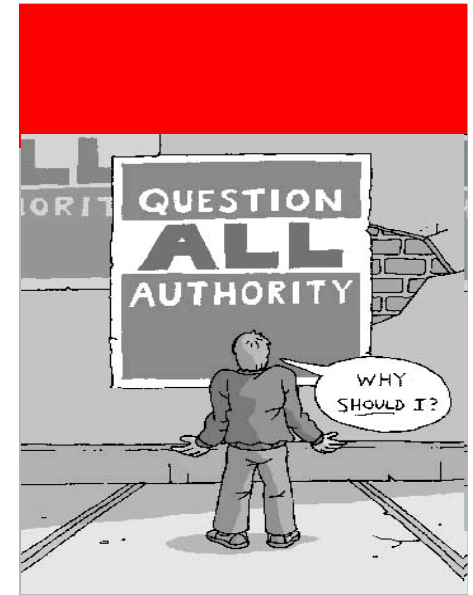
**Don't tune a query – tune a process, an algorithm, the entire approach.**

*Don't fall into the sunk cost theory...*



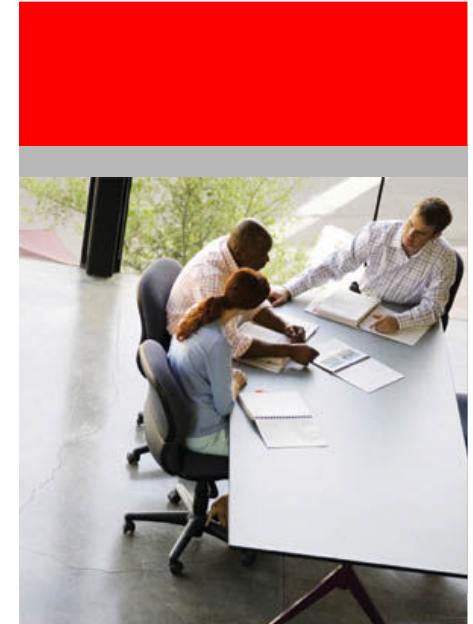
**Always Question Everything –  
in a non-annoying way of  
course!**

*Question Authority...*



**Never stop testing ideas –**  
**Things change, I still**  
**remember how it worked in**  
**version 5.**

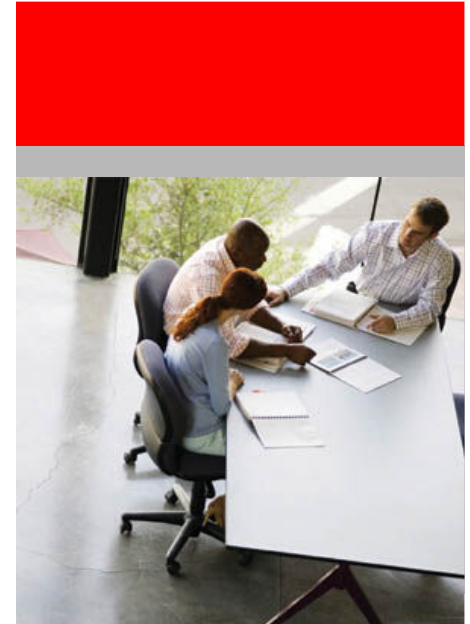
*The tuning techniques (best practices)*  
*of yesterday are today's performance /*  
*maintenance headaches...*





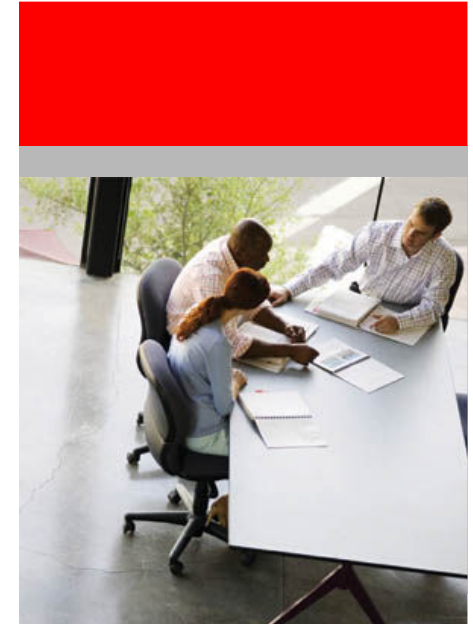
**Don't rule anything out until you try it – How do you *know* it won't work unless you try it. Just because it didn't work in a different *context* doesn't mean it won't work now.**

***You can't use any feature until it is 3 releases old – this is software, not fine wine...***



**The simple solution is usually right** – There are many ways to build an application. Not all of them need 14 tiers. Many applications are quite simple – there is room for many tools.

*We get caught up in the novelty of the idea that we ignore how practical it really is...*



**Collaborate – Participate,  
Network, Exchange ideas.**

*I learn something new every day about  
Oracle – from the questions I get about  
Oracle...*





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## **The Best Way...**

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**What we know, shapes how we do things...**