# Performance Monitoring

# Top 5 reasons for slow queries

# 1. Bad Query

- This is the most common reason for long running query.
- Your query is not using any kind of index: Primary Index, Secondary Index or Partition Primary Index.
- The tables are getting redistributed and those big tables taking long time in it.

## 2. Delay Time

- Check for Delay time in DBQL ( `dbc.dbqlogtbl` ) for your query.
- It may happen that query execution time is in seconds however it was in Delay queue for hours.

# 3. Blocking

- It may happen that your query is blocked by some other query.
- Also watch out for TDM jobs. Such jobs generally apply exclusive locks on the table, thereby blocking all other queries requesting the same table.
- You can check this Teradata Viewpoint Monitor Portlet.

# 4. Server State

- Generally Teradata Server status is classified as Healthy, Degraded, Critical and Down.
- As the number of concurrent users increase the load on server also increases.
- With more load on server and AMP doing more work, your query may take more time than usual time.

# 5. Skewness

- Check skewness factor and change the PI if needed.

# Improving your query

## `DISTINCT`

- `DISTINCT` is better for columns with a low number of rows per value:
  Number of rows < Number of AMPs
- `GROUP BY` is better for columns with a large number of rows per value:
  Number of rows > Number of AMPs

# Date Comparison

- When comparing values of date in a particular range, the query may result in product join.
- This can be avoided with the usage of `SYS_CALENDAR.CALENDAR`, which is Teradata's in-built database.

# Example

```
select
t2.a1,t2.a2,t2.a3,t2.a4
from
table2 t2
join table3 t3
on t2.a1=t3.a1
and t2.a5_dt>=t3.a4_dt
and t2.a5_dt<=t3.a5_dt;
```

```
select
t2.a1,t2.a2,t2.a3,t2.a4
from table2 t2
join SYS_CALENDAR.CALENDAR sys_cal
on sys_cal.calendar_date = t2.a5_dt
join table3 t3
on t2.a1=t3.a1
and sys_cal.calendar_date >=t3.a4_dt
and sys_cal.calendar_date <=t3.a5_dt;
```

# Identify suspect queries

## Beyond `EXPLAIN`

- **Product Join Indicator:** the ratio of CPU Seconds to IO for a query. ( `AMPCPUTime` * 1000) / `TotalIOCount`
  - $\geq$ 3: the query should be reviewed.
  - $\geq$ 6: potentially an unnecessary product join.

# Beyond `EXPLAIN` (cont.)

- **Unnecessary IO Indicator:** is the ratio of IO to CPU Seconds, `TotalIOCount` / ( `AMPCPUTime` * 1000)
  - Number of rows read / number of rows processed.
  - $\geq$ 3: the query should be reviewed to eliminate full-table scans and possibly redistribution steps.
  - Good indicator

# Beyond `EXPLAIN` (cont.)

- **Product Join Indicator**, ( `AMPCPUTime` * 1000)/ `TotalIOCount`
- PJI is the measure of how CPU intensive your query is.
  - If PJI $\geq$ 3 you should review the query, PJI $\geq$ 6 it might be a product join.
  - This value is high during a product join, but not only.

# Beyond `EXPLAIN` (cont.)

- Both metrics are available in Viewpoint's Query Monitor portlet, and every individual query has these values displayed when you click on the session ID.
- You can also track them using `dbqlogtbl` & `dbqlsqltbl` tables in `dbc`.

# Set up `dbql`

- You can check if this is activated:

  `SELECT * FROM dbc.dbqlrulesv;`

- If not activated, it can be set up by the DBA in `BTEQ`.

```
begin query logging with objects,
sql, usecount, utilityinfo LIMIT SQLTEXT=0 on all;

begin query logging with objects,
sql limit threshold = 5 elapsedsec
and sqltext=0 on VIEWPOINT;
```

# Monitoring

```
SET QUERYBAND = 'Version=1' FOR SESSION;

SELECT
AMPCPUTIME,
(FIRSTRESPTIME-STARTTIME DAY(2) TO SECOND(6)) RUNTIME,
SPOOLUSAGE/1024**3 AS SPOOL_IN_GB,
AMPCPUTIME*1000/TOTALIOCOUNT AS PJI,
TOTALIOCOUNT/(AMPCPUTIME*1000) AS UIOI
FROM DBC.DBQLOGTBL
WHERE QUERYBAND = 'Version=1';
```

# Monitoring (cont.)

The query will return:

- Total CPU Usage
- Spool Space needed
- PJI/LHR (ratio between CPU and IO usage)
- CPU Skew
- Skew Impact on the CPU
- **Goal:** cut total CPU usage, consumed spool space and skew.

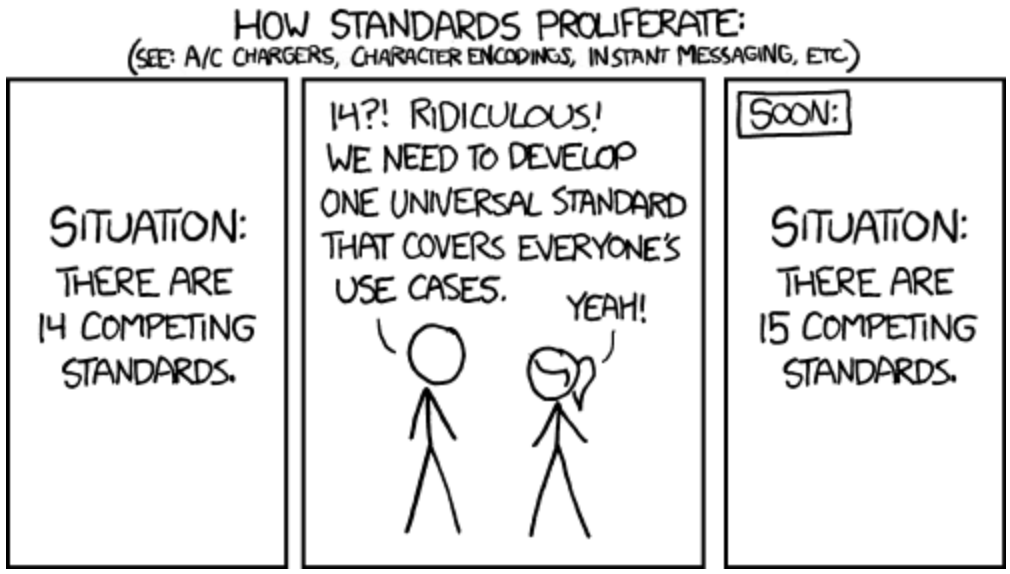
# Prevention

# Good Schema Design

- In a perfect world, we don't need to optimize our queries because the schema is just great.
- Data is **normalized**: tables are organized to reduce disk space *and* redundancy.
- We want to avoid situations like having `EmployeeSalary` in a `Customers` table. Or, even worse, a single, huge table with everything.
- **More rows, less columns.**

# Normalization

- Different rules for normalization.
- Depending how many of those are followed, we say that the database is in First Normal Form, Second Normal Form (5 and counting).
- Third Normal Form (3NF) is the standard recommended by Teradata, and usually the last necessary.


HOW STANDARDS PROLIFERATE:
(SEE: A/C CHARGERS, CHARACTER ENCODINGS, INSTANT MESSAGING, ETC)
SITUATION: THERE ARE 14 COMPETING STANDARDS.
14?! RIDICULOUS! WE NEED TO DEVELOP ONE UNIVERSAL STANDARD THAT COVERS EVERYONE'S USE CASES.
YEAH!
SOON:
SITUATION: THERE ARE 15 COMPETING STANDARDS.

# First Normal Form

- Eliminate columns with repeated information in individual tables.
- Create a separate table for each set of related data.
- Identify each set of related data with a primary key.

# Second Normal Form

- Create separate tables for sets of values that apply to multiple records.
- Relate these tables with a foreign key.
- **Example:** `CustomerAddress`. You need this information in your `Orders`, `Invoices` and `Customers` table. Instead of duplicating it, it should be only on `Customers` table.

# Third Normal Form

- Eliminate fields that do not depend on the key.
- In the previous example, that could mean storing `CustomerAddress` in its own `Addresses` table.
- Theoretical advantages, but maybe not practical: it would mean having a lot of small tables in some cases, which can degrade performance.

# Normalizing an Example Table

These steps demonstrate the process of normalizing a fictitious student table.

**Unnormalized table:**

| StudentId | Advisor Adv-Room | Class1 | Class2 | Class3 |
|---|---|---|---|---|
| 1022 | Jones | 412 | 101-07 | 143-01 |
| 4123 | Smith | 216 | 201-01 | 11-02 |

# First Normal Form: No duplicate columns

| StudentId | Advisor | Adv-Room | ClassId |
|---|---|---|---|
| 1022 | Jones | 412 | 101-07 |
| 1022 | Jones | 412 | 143-01 |
| 1022 | Jones | 412 | 159-02 |
| 4123 | Smith | 216 | 201-01 |
| 4123 | Smith | 216 | 211-02 |
| 4123 | Smith | 216 | 214-01 |

# Second Normal Form: Separate tables

| StudentId | Advisor | Adv-Room |
|---|---|---|
| 1022 | Jones | 412 |
| 4123 | Smith | 216 |

| StudentId | ClassId |
|---|---|
| 1022 | 101-07 |
| 1022 | 143-01 |
| 1022 | 159-02 |
| 4123 | 201-01 |
| 4123 | 211-02 |
| 4123 | 214-01 |

# Third Normal Form

| StudentId | Advisor |
| --- | --- |
| 1022 | Jones |
| 4123 | Smith |

| Name | Room | Dept |
| --- | --- | --- |
| Jones | 412 | 42 |
| Smith | 216 | 42 |

# Why not to normalize?

- Joins are expensive.
- Prototyping should be *quick and dirty*.
- If using NoSQL databases.

# Other tips

- Primary key *need not be* a business attribute (e.g. ID Number). These may change!
- Multi-column Primary Key = Bad idea in general.

# Other tips (cont.)

- Add constraints on the database, specially unique (when relevant).
- **Avoid bad names,**
  - `id` in `Customers` and `product_id` in `Products`.
  - Non-ASCII characters, whitespace, reserved words.
  - Mixing plural and singular.
  - Or mixing_underscore and CamelCase
- Hard Delete vs Soft Delete: Flag as 1/0 for active/inactive instead of deleting.