Tera-Tom Coffing

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on Teradata Architecture and SQL

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Teradata Space
OLAP Ordered Analytics
Date Functions

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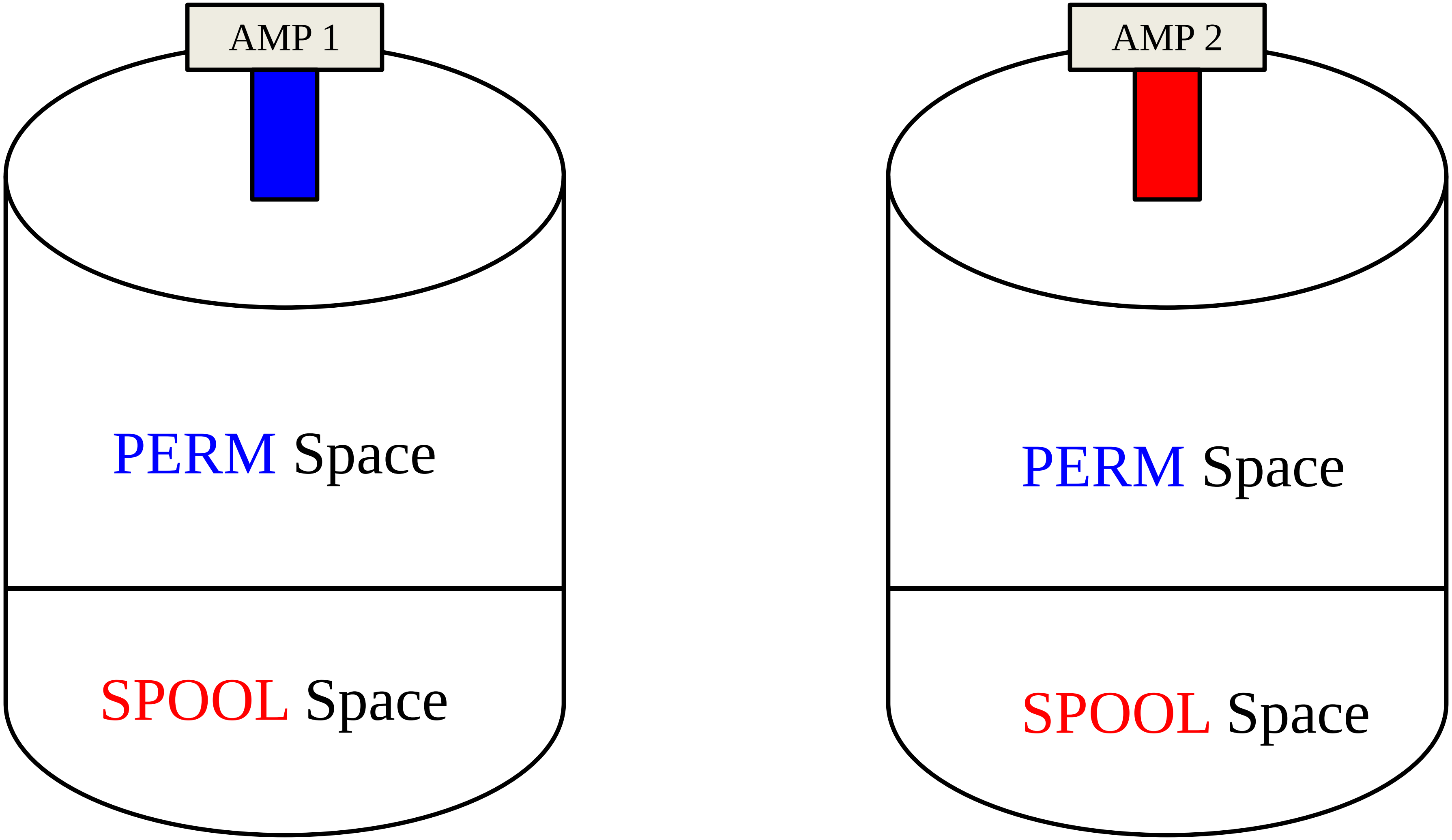
Space

"For the wise man looks into **space** and he knows there is no limited dimensions."

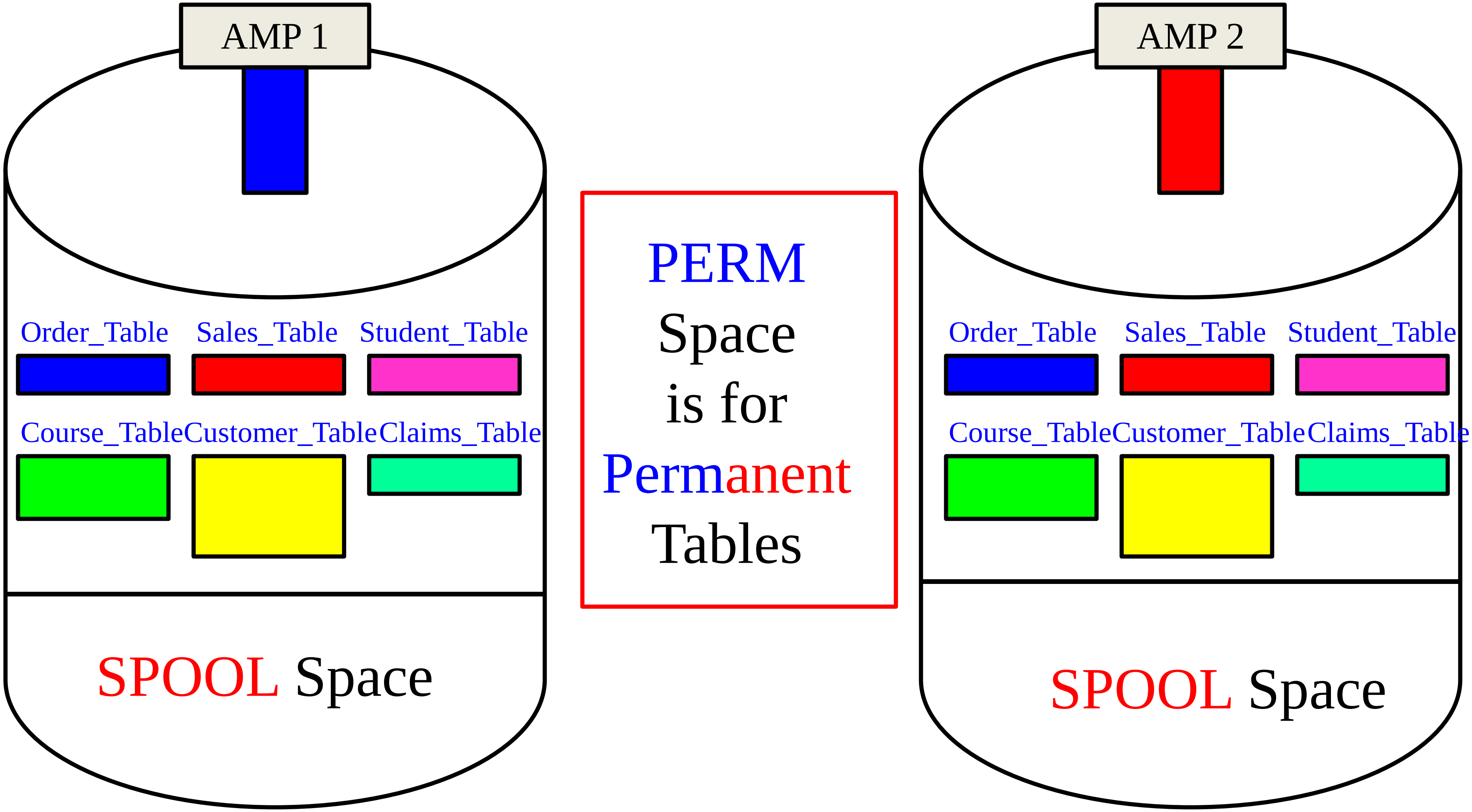
- Lao-tzu

Perm and Spool Space



Space has only to do with space on the data warehouse disks. Each AMP controls their own disk farm and about 60% of each disk will be used for tables and that is called PERM space. The other 40% (Spool) is work space for user queries and answer sets.

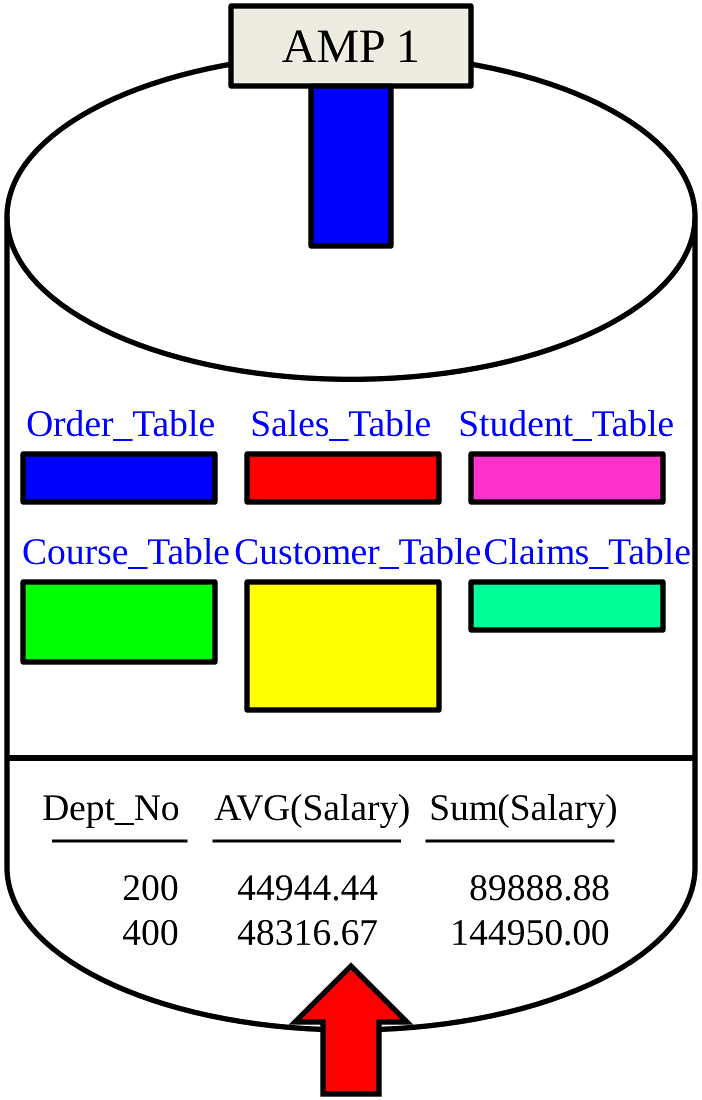
Perm Space is for Permanent Tables



PERM
Space
is for
Permanent
Tables

PERM Space is where an AMP keeps its tables. That is what you need to understand. You will also find out that PERM spaces also houses Secondary Indexes, Join Indexes and Permanent Journals. Just remember that PERM is for the tables and indexes!

Spool Space is work space that builds a User's Answer Sets



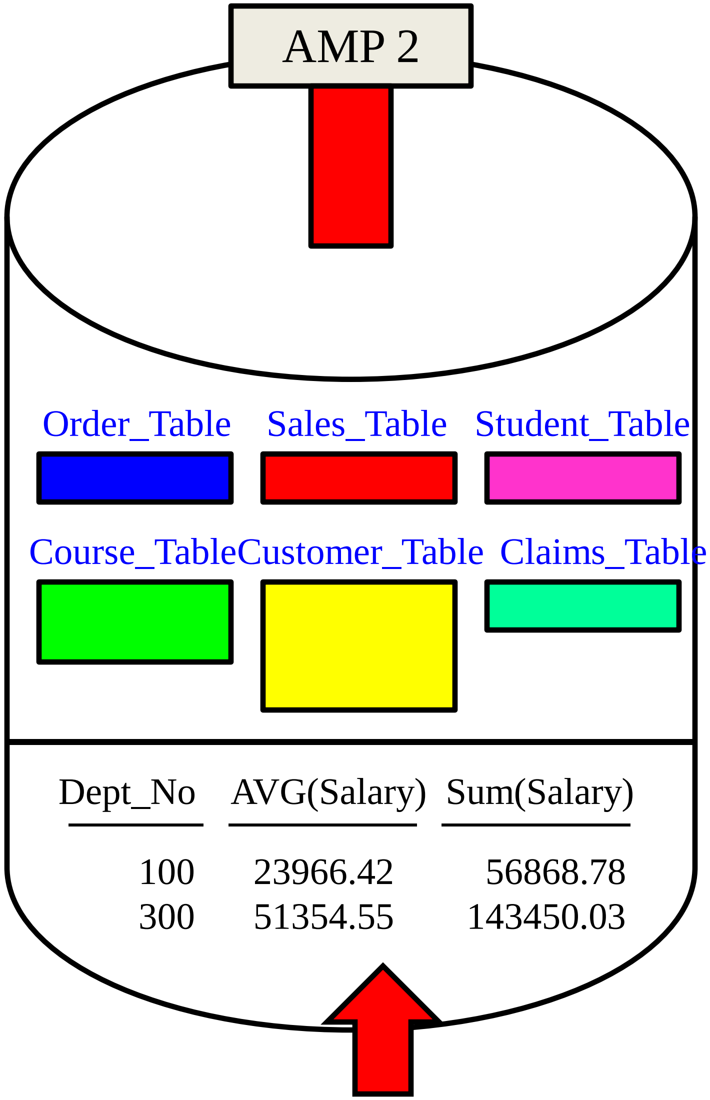
AMP 1

Order_Table Sales_Table Student_Table

Course_Table Customer_Table Claims_Table

Dept_No	AVG(Salary)	Sum(Salary)
200	44944.44	89888.88
400	48316.67	144950.00

Spool is used by the AMPS as workspace to build a User's Answer Sets



AMP 2

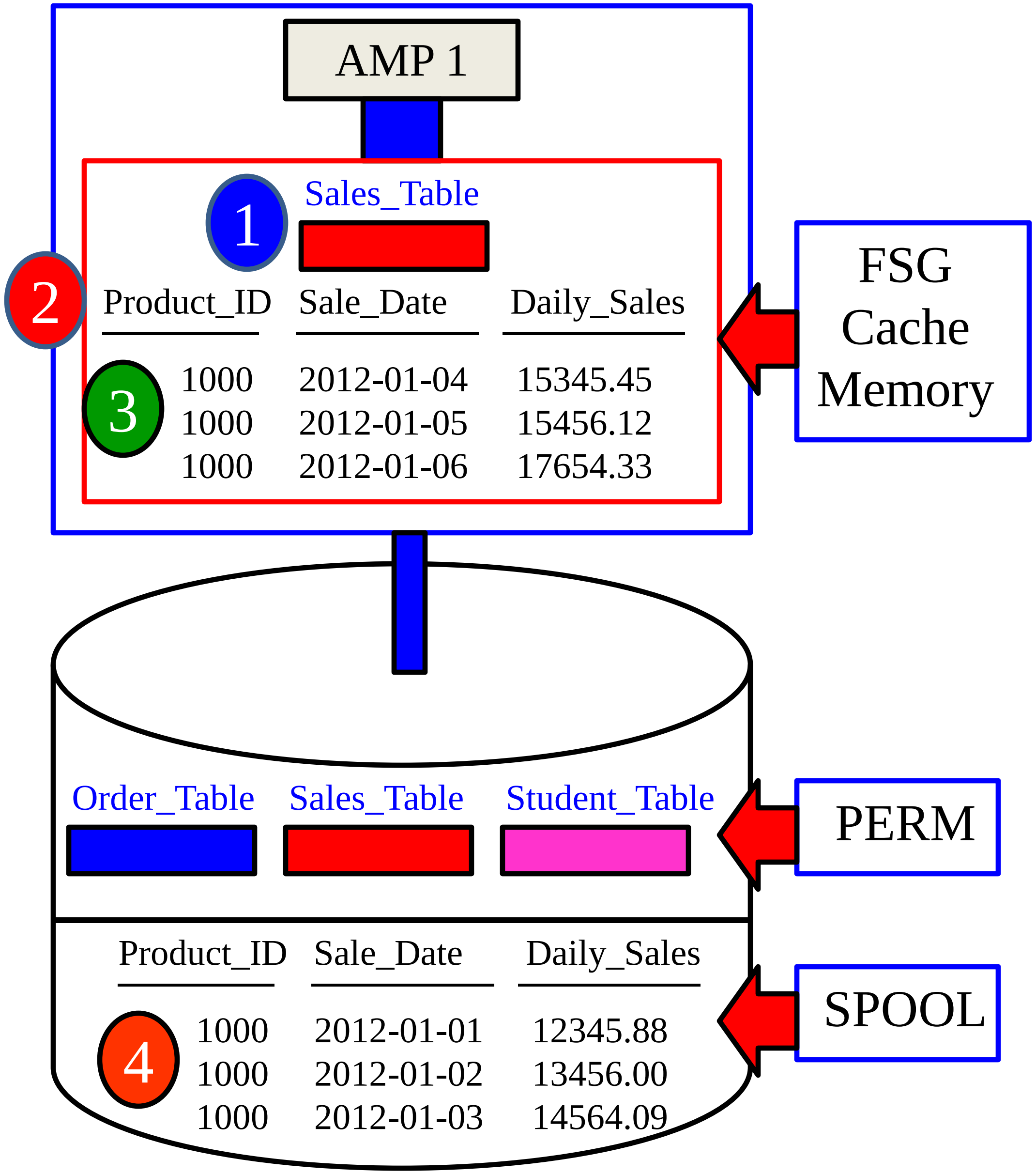
Order_Table Sales_Table Student_Table

Course_Table Customer_Table Claims_Table

Dept_No	AVG(Salary)	Sum(Salary)
100	23966.42	56868.78
300	51354.55	143450.03

Spool space is used by each AMP in order to build the answer set for the user.

Spool Space is in an AMPs memory and on its Disk



AMP 1

1 Sales_Table

2

Product_ID	Sale_Date	Daily_Sales
1000	2012-01-04	15345.45
1000	2012-01-05	15456.12
1000	2012-01-06	17654.33

3

FSG Cache Memory

Order_Table

Sales_Table

Student_Table

PERM

Product_ID	Sale_Date	Daily_Sales
1000	2012-01-01	12345.88
1000	2012-01-02	13456.00
1000	2012-01-03	14564.09

4

SPOOL

1 Transfer the Sales_Table from the disk (Perm) to FSG Memory.

2 Get the Product_ID, Sale_Date and the Daily_Sales columns.

3 Build the Report in FSG Cache.

4 If there is no more room in FSG Cache than transfer the report to Spool on Disk.

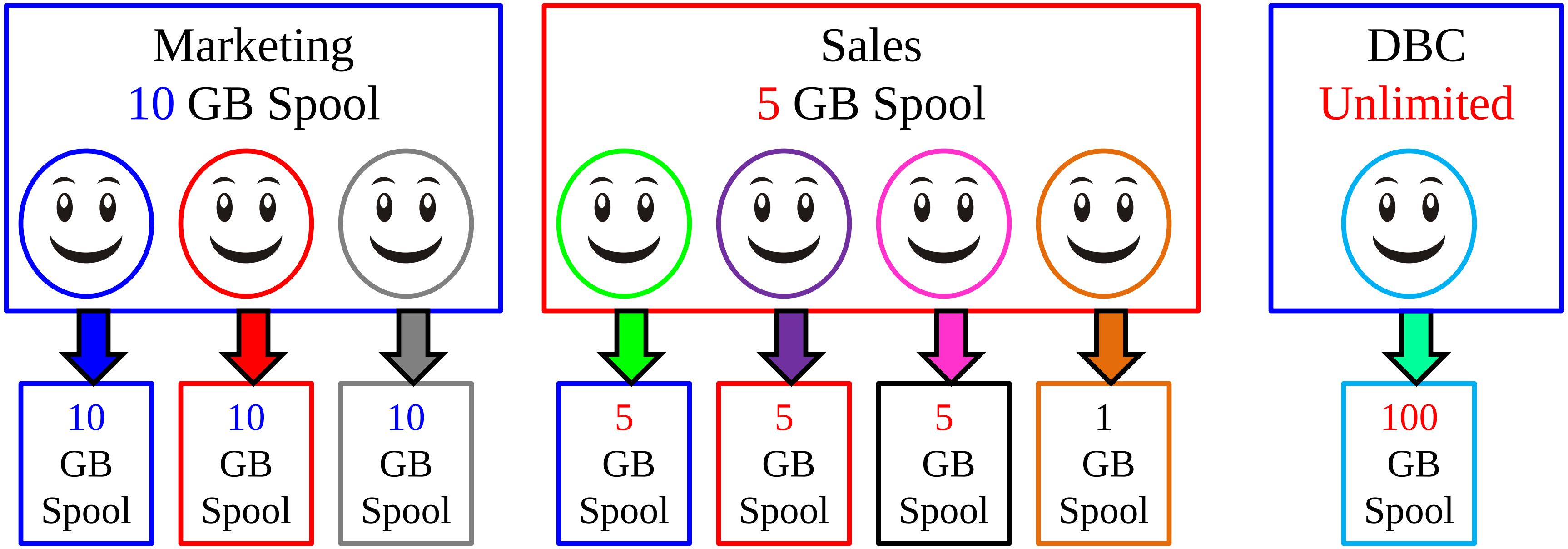
5 Keep checking if the USER has gone over their SPOOL Limit.

6 The Report is done so transfer the report to the Parsing Engine over the BYNET.

7 DELETE the Spool Files.

AMPs have memory called File System Generating Cache (FSG) used for processing.

USERs are Assigned Spool Space Limits



Every User is assigned Spool Space so they can submit SQL and retrieve answer sets.

The Spool in the database Marketing is 10 GB so each user defaults to 10 GB of Spool.

Any User in Marketing can run queries, but are aborted if they go over the 10 GB limit.

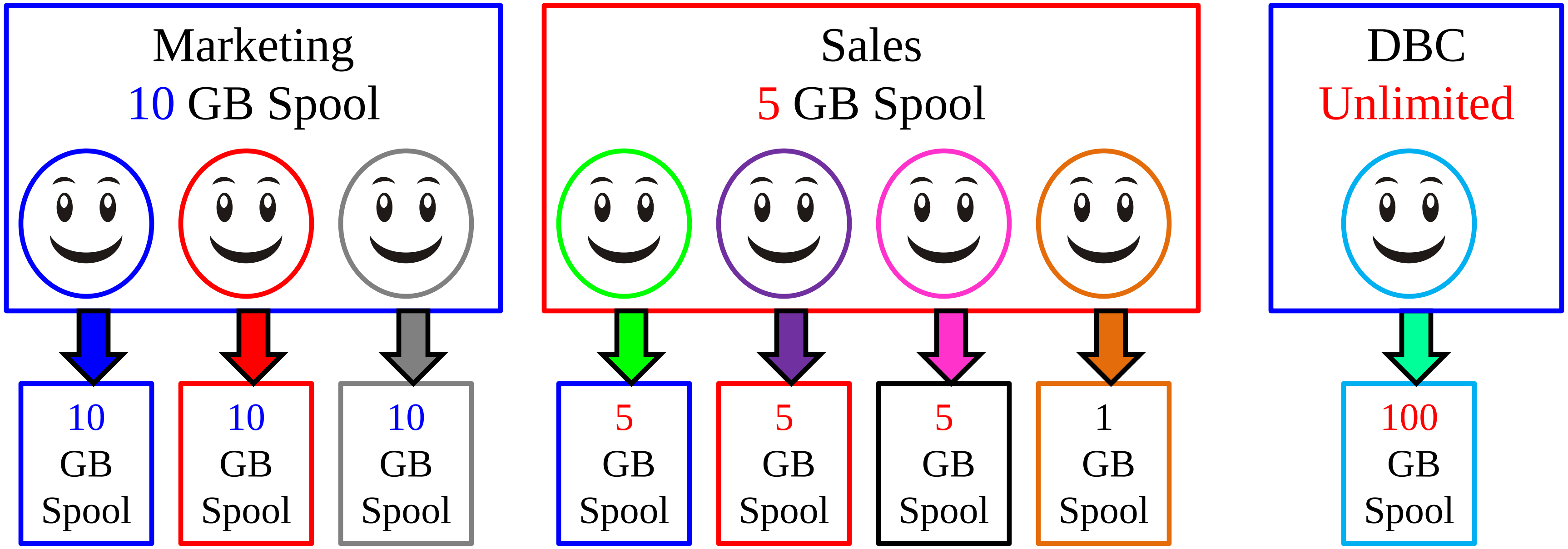
All 3 users in Marketing can query simultaneously and use 30 GB of Spool in total .

Three users in Sales defaulted to the max (5 GB) but the intern was assigned less.

The final user in DBC was given 100 GB of Spool because their brilliant.

Spool is assigned to users and the only way you are aborted is if you go over your spool limit. Marketing has unlimited spool, but the max for each user in marketing is 10 GB!

What is the Purpose of Spool Limits?



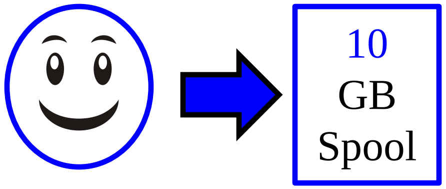
There are two reasons for Spool Limits:

If a user makes a mistake and runs a query that could take weeks to run it will abort the second the user goes over their allotted spool limit.

It keeps users from hogging the system.

Spool is assigned to users and the only way a user is aborted is if they go over their spool limit. Marketing, Sales, and DBC have unlimited spool, but the max for each individual user is 10 GB in Marketing, 5 GB in Sales, and our power user is at 100 GB.

Why did my query Abort and say “Out of Spool”?



How is it possible that I ran out of spool?

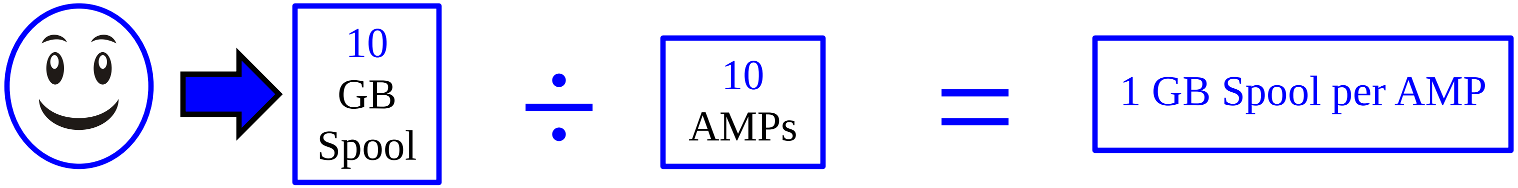
You ran out of spool because your query used over your limit of 10 GB of spool.

It is also possible that you have logged onto multiple machines or ran multiple queries and the combination went over 10 GB of spool.

It is also very likely that the data you were working with was NOT evenly distributed (skewed) and this is a major cause of Spool errors.

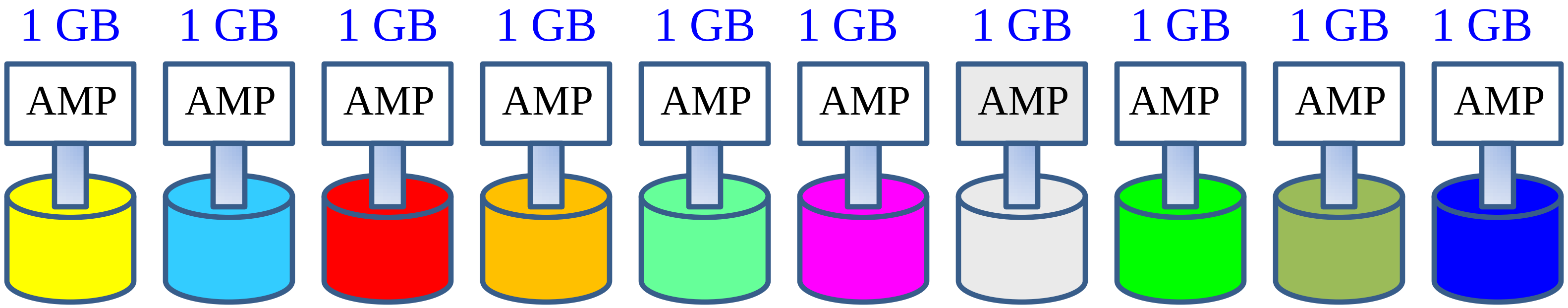
Spool is assigned to users and the only way a user is aborted is if they go over their spool limit. No user has ever failed because they are in Marketing and Marketing has only 10 GB of spool. It doesn’t work that way. Thousands of users in Marketing could run queries simultaneously because Marketing has unlimited amounts of spool, but each user in Marketing can’t go over the default Max of 10 GBs for an individual user.

How can Skewed Data cause me to run “Out of Spool”?



10 GB Spool ÷ 10 AMPs = 1 GB Spool per AMP

Each User’s Spool limit is actually done per AMP so if you are assigned 10 GBs of spool and the system has 10 AMPs you are really assigned 1 GB of Spool per AMP!



1 GB 1 GB 1 GB 1 GB 1 GB 1 GB 1 GB 1 GB 1 GB 1 GB

AMP AMP AMP AMP AMP AMP AMP AMP AMP AMP

If data is skewed and you exceed your 1 GB limit on any AMP you are “out of spool”.

Spool is assigned to every user, but since Teradata is a parallel processing system each AMP is only concerned with themselves. Each AMP processes their portion of the data in parallel. Because of this philosophy your Spool Space (10 GB) is divided among the total AMPs in the system. If you have 10 GBs of Spool and there are 10 AMPs you get 1 GB per AMP. If you go over 1 GB on any AMP you are aborted and “Out of Spool”.

How come my Join caused me to run "Out of Spool"?

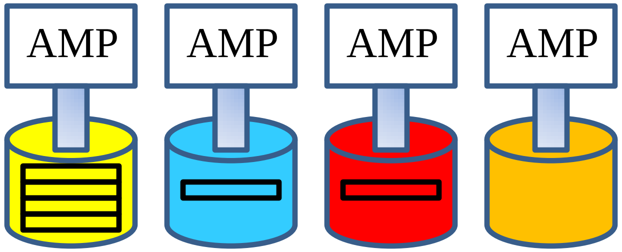
1 You might not have put in a Join Condition.

```
SELECT First_Name, Last_Name, Department_Name
FROM    Employee_Table    as E
           INNER JOIN
           Department_Table as D
```

2 You might have Aliased the table and then fully qualified with the real table name.

```
SELECT First_Name, Last_Name, Department_Name
FROM    Employee_Table    as E
           INNER JOIN
           Department_Table as D
ON   Employee_Table.Dept_No = D.Dept_No ;
```

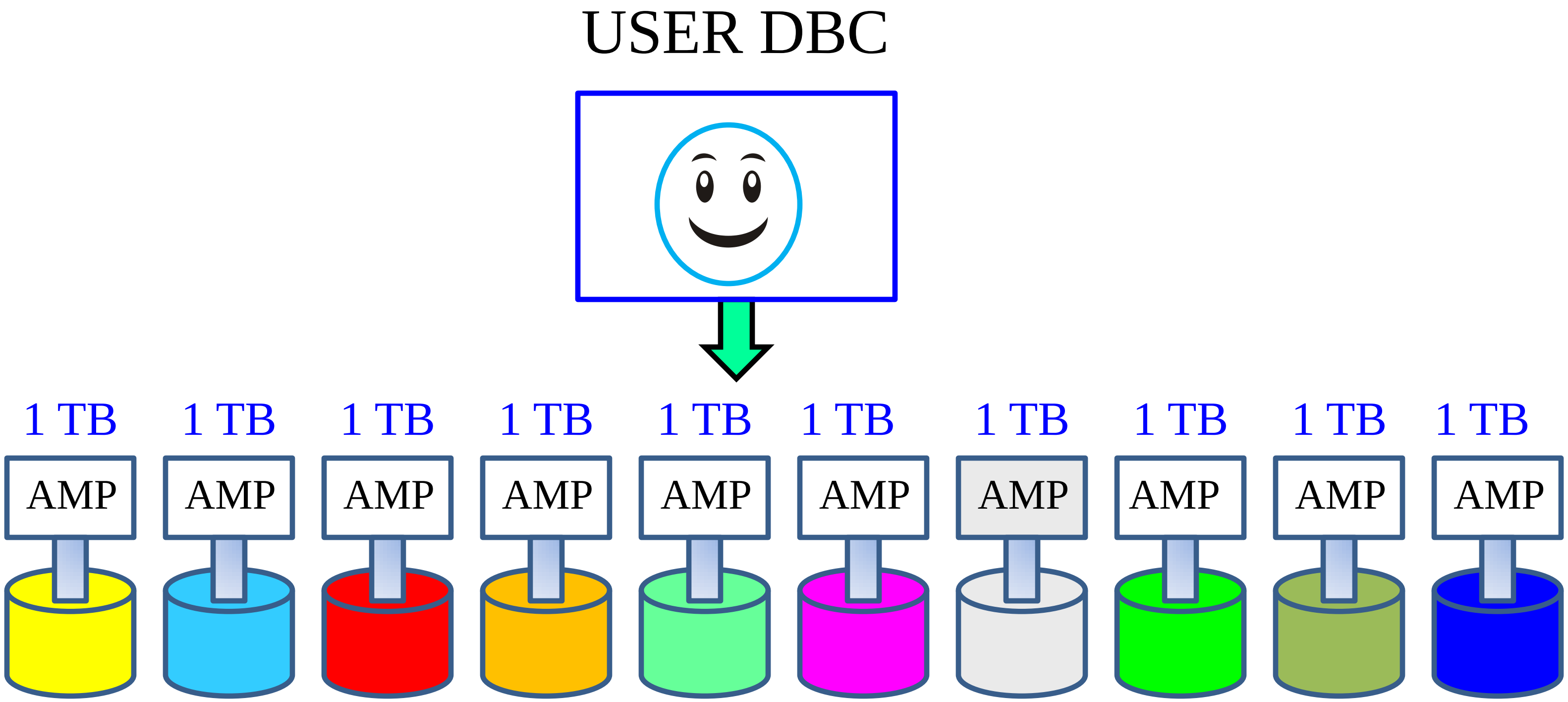
3 There might be skewed data on one of the tables.



4 A Lot of NULLs on a table on an Outer Join.

```
SELECT e.*, d.* from Employee_Table as E
LEFT OUTER JOIN Department_Table as D
ON E.Dept_No= D.Dept_No ;
```

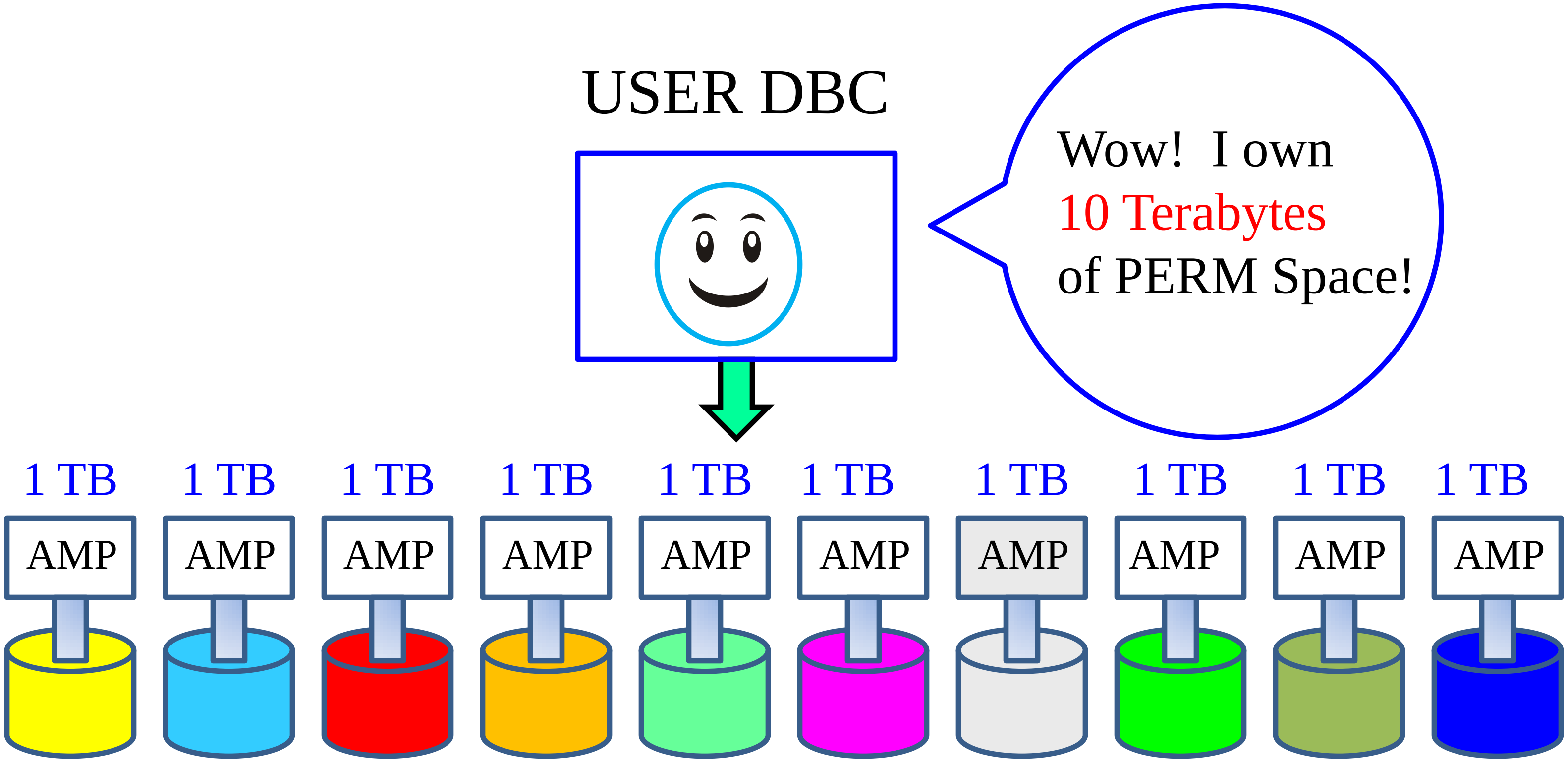
What does my system look like when it first arrives?



All Teradata systems start with one USER called DBC.

The first Teradata machine ever built came out in 1988 and it was called the DBC 1012. The DBC portion stood for Database Computer. The 1012 was named because 10 to the 12th power is equal to a Terabyte. So, the DBC 1012 was a Database Computer designed to process Terabytes of data. So, every system starts with one USER called DBC and DBC owns all the PERM Space in the system.

DBC owns all the PERM Space in the system on day one



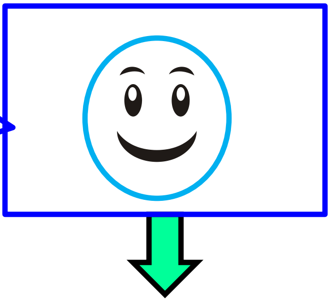
When the system starts out new and arrives at your company DBC is the only USER. DBC counts up all the disk space attached to each AMP and considers that PERM Space owned by DBC.

DBC owns all the disk space on day one of your systems arrival. DBC will then begin to put out space to other databases or users.

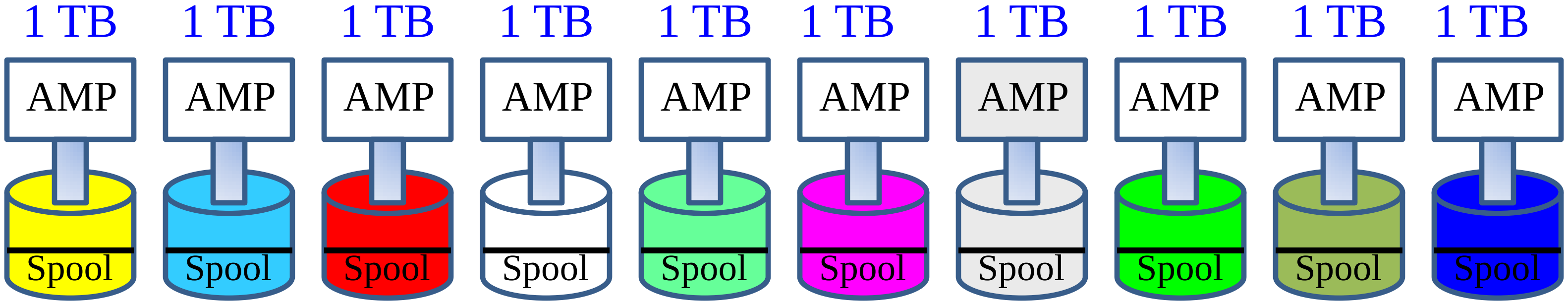
DBC's First Assignment is Spool Space

I will CREATE a Database called Spool_Reserve to ensure Spool Space for everyone!

USER DBC



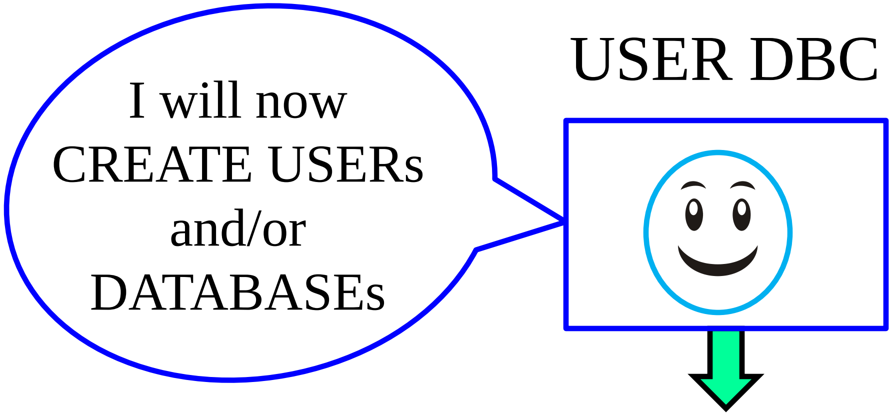
```
CREATE DATABASE
Spool_Reserve
  FROM DBC
  AS
  PERM  =  4000000000000
  SPOOL = 4000000000000;
```



DBC will create a database called Spool_Reserve (any name will do), but it will reserve between 20% to 40% for Spool. What really happens is that DBC creates Spool_Reserve to claim PERM Space, but never places a table in the database.

When a database is given PERM Space and no object is created in that database it is used for Spool. Spool is unused PERM!

DBC's 2nd Assignment is to CREATE Users and Databases



USER DBC

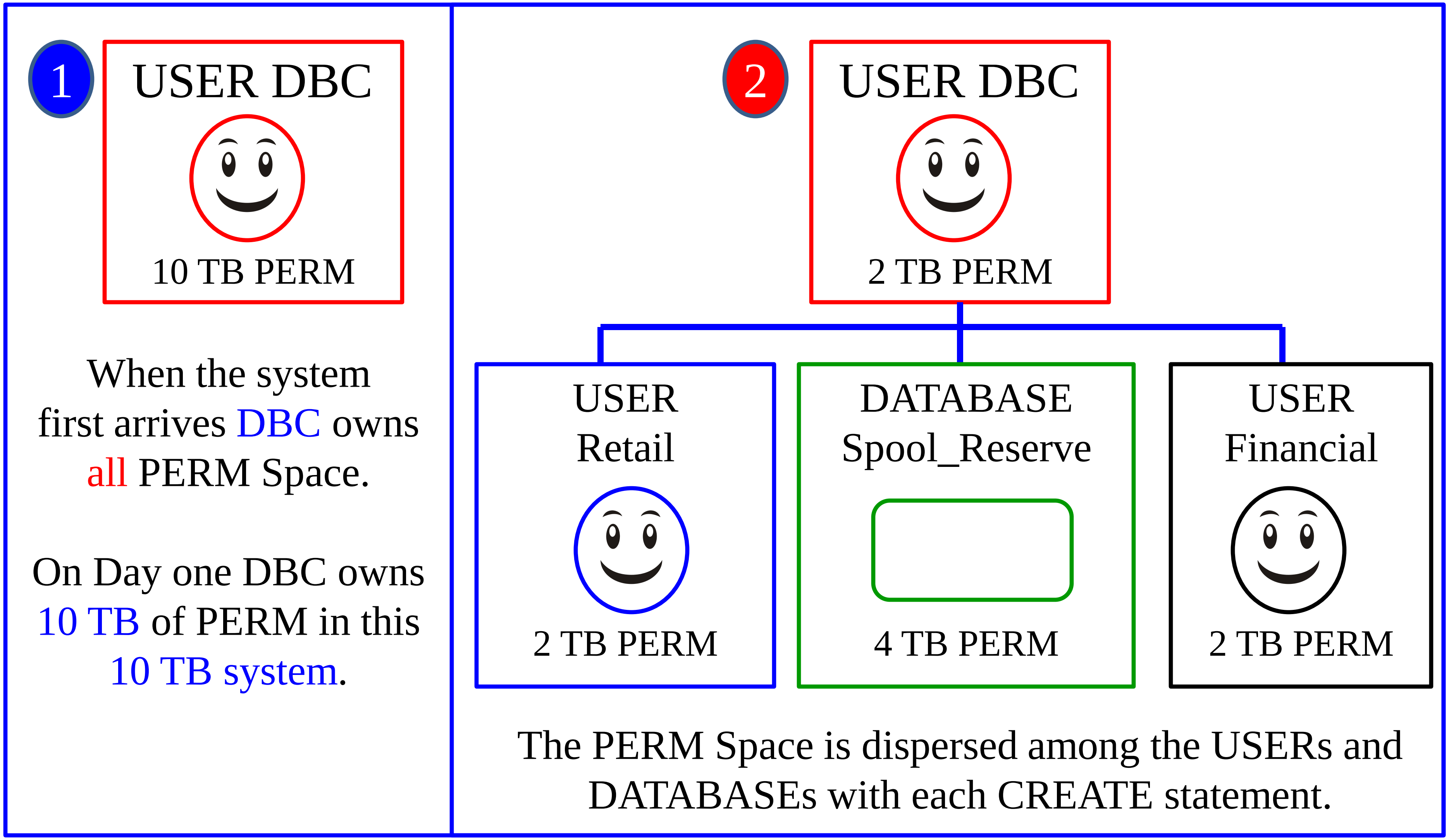
I will now CREATE USERs and/or DATABASEs

```
CREATE USER Retail
    FROM DBC
  AS
    PASSWORD=abc123
    PERM=200000000000
    SPOOL=10000000000
    TEMPORARY = 10000000000
    ACCOUNT='$Med'
    DEFAULT DATABASE = DBC ;
```

```
CREATE USER Financial
    FROM DBC
  AS
    PASSWORD=abc123
    PERM=200000000000
    SPOOL=5000000000
    TEMPORARY = 10000000000
    ACCOUNT='$Med'
    DEFAULT DATABASE = DBC ;
```

DBC's 2nd assignment will be to create some USERs or DATABASEs and the hierarchy begins. If a USER or DATABASE is assigned PERM space it can CREATE tables.

The Teradata Hierarchy Begins



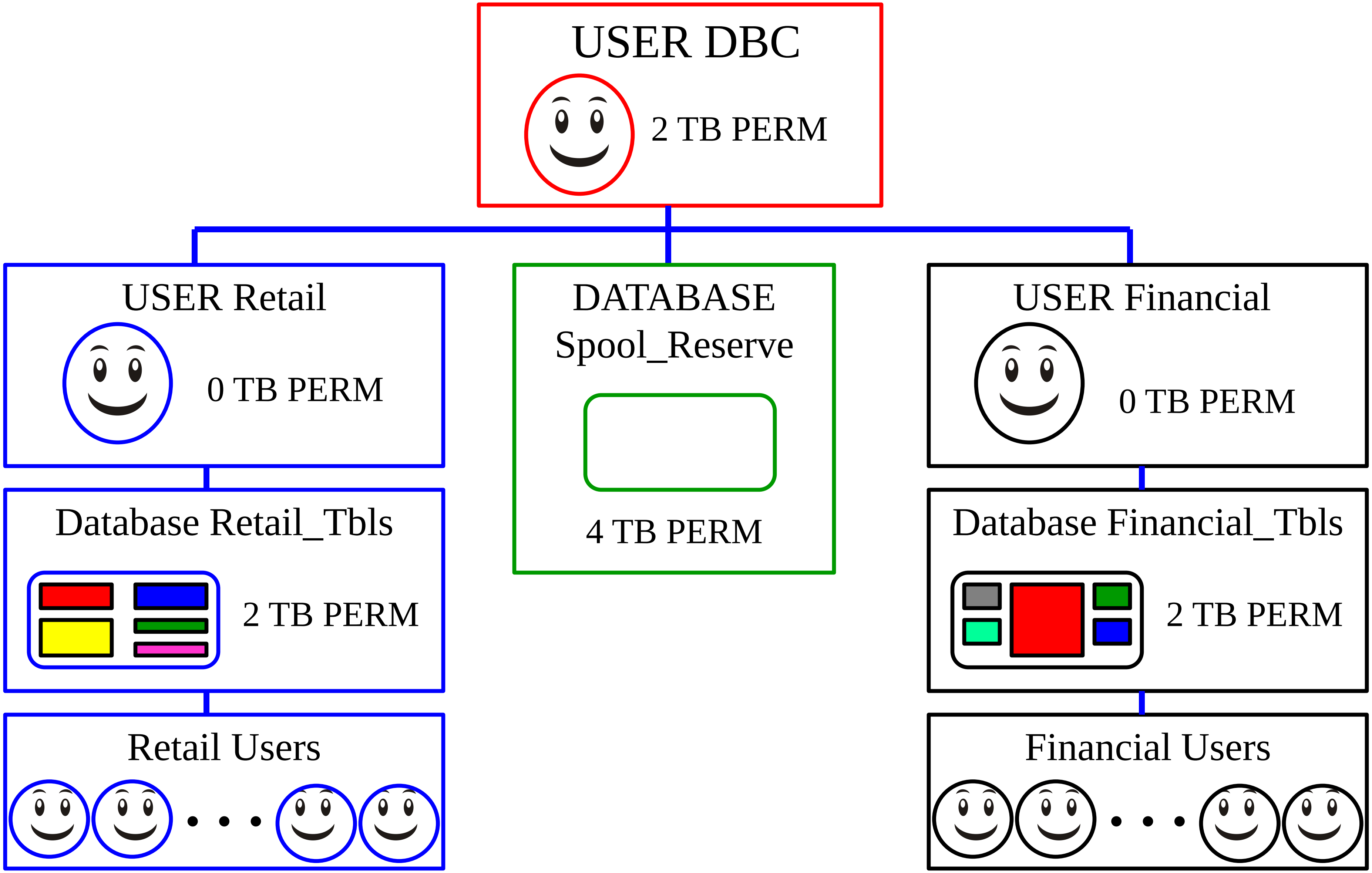
When the system first arrives DBC owns all PERM Space.

On Day one DBC owns 10 TB of PERM in this 10 TB system.

The PERM Space is dispersed among the USERs and DATABASEs with each CREATE statement.

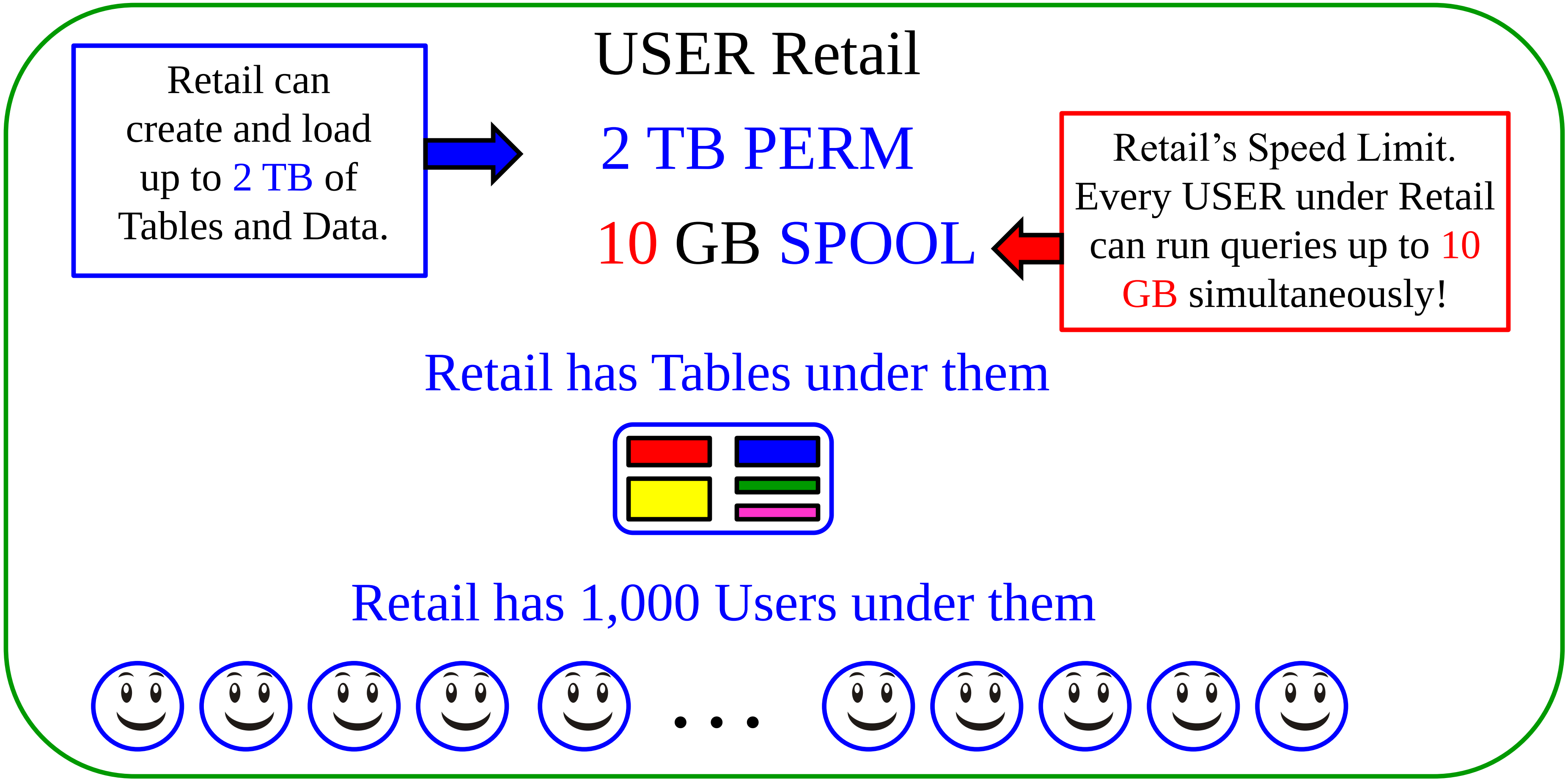
Notice in example 1 that DBC owns 10 TB of PERM space. Notice that after DBC created Spool_Reserve (4 TB), USER Retail (2 TB) and USER Financial (2 TB) that DBC now only owns only 2 TB of PERM space.

The Teradata Hierarchy Continues



USER Retail and USER Financial now create the databases and users desired.

Differences between PERM and SPOOL



USER Retail

2 TB PERM

10 GB SPOOL

Retail can create and load up to 2 TB of Tables and Data.

Retail's Speed Limit. Every USER under Retail can run queries up to 10 GB simultaneously!

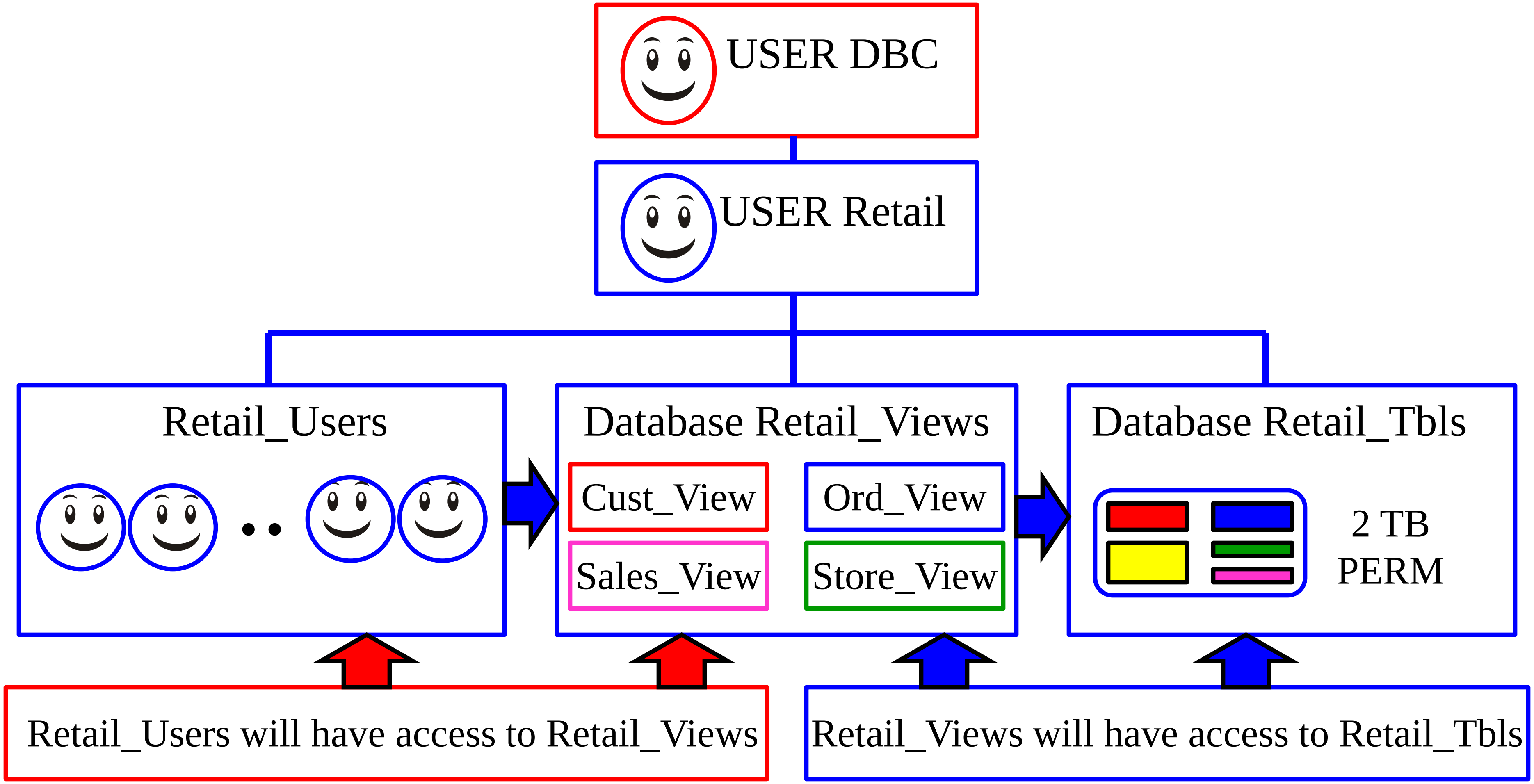
Retail has Tables under them

Retail has 1,000 Users under them

. . .

There are 1,000 users in Retail. Since Retail has 10 GB of spool that means that every user gets 10 GB of spool. That is the maximum limit for Retail. What it does NOT mean is that Retail is limited to only 10 GB of spool in total. Every user could logon and run a 9 GB query taking up Terabytes of Spool and nobody would run out of spool. Spool is system wide and calculated on an individual level only.

Databases, Users, and Views

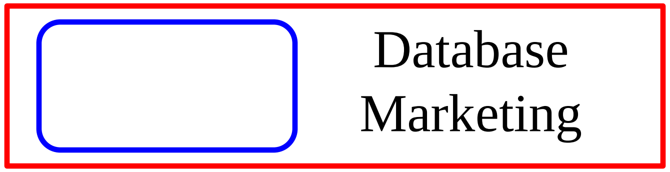


Retail_Users will have access to Retail_Views

Retail_Views will have access to Retail_Tbls

For security purposes the Retail tables will be kept in their own database called Retail_Tbls (in this example). The general Retail User Population will NOT have access directly to these tables. A Database called Retail_Views houses the views that access the tables. So, the DBA will create Access Rights that allow the views to read the tables and the Users to SELECT from the views.

What are Similarities between a DATABASE and a USER?



Database
Marketing

USER
Maria

1 A Database or a User can be assigned PERM Space

A If the Database Marketing is assigned 10 GB of PERM that means it can hold up to 10 GB of Permanent Tables.

B If the User Maria is assigned 10 GB of PERM that means she can hold up to 10 GB of Permanent Tables.

2 A Database or a User can be assigned Spool Space

A If the Database Marketing is assigned 10 GB of Spool that means all users under marketing can each run 10 GB queries.

B If the User Maria is assigned 10 GB of Spool that means she can run up to 10 GB queries and any user created under Maria will default to 10 GB queries.

What is the Difference between a DATABASE and a USER?

Database
Marketing

USER
Maria

A USER has a login and password and therefore can run queries

Objects that take up PERM Space

Permanent Space (Perm space) is the maximum amount of storage assigned to a user or database for holding:

- Table Rows
- Fallback Tables
- Secondary Index Subtables
- Stored Procedures
- User Defined Functions (UDFs)
- Permanent Journals

Views and Macros do NOT take up any Perm Space!

A Series of Quizzes on Adding and Subtracting Space

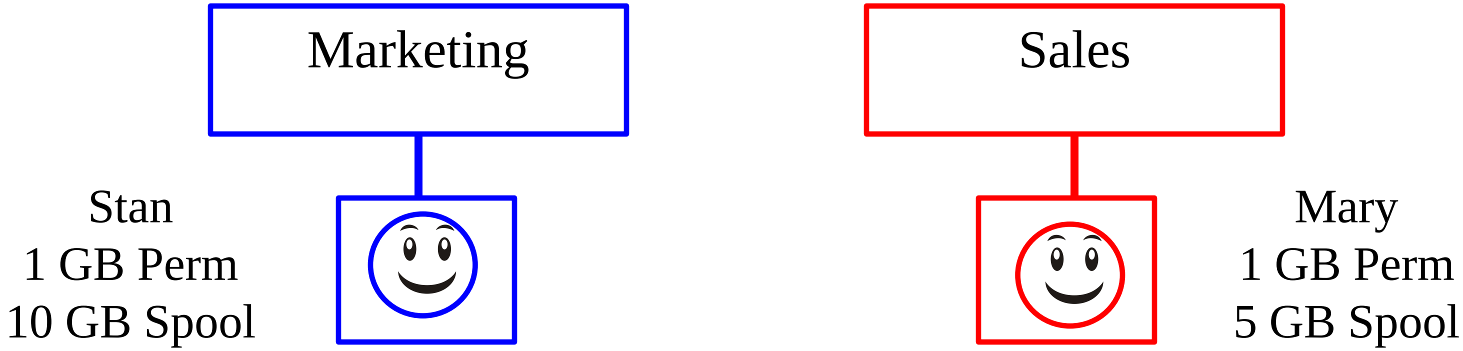
Marketing
10 GB Perm
10 GB Spool

Sales
5 GB Perm
5 GB Spool

1 Marketing has 10 GB of Perm and Spool. Sales has 5 GB Perm and Spool.

2 Marketing then Creates Stan and gives him 1 GB Perm and 10 GB Spool.

3 Sales then Creates Mary and gives her 1 GB Perm and 5 GB Spool.



Marketing

Stan
1 GB Perm
10 GB Spool

Sales

Mary
1 GB Perm
5 GB Spool

After creating users how much Perm / Spool is in Marketing and how much is in Sales?

________________ ____________________   ___________________ ________________

Answer 1 to Quiz on Space

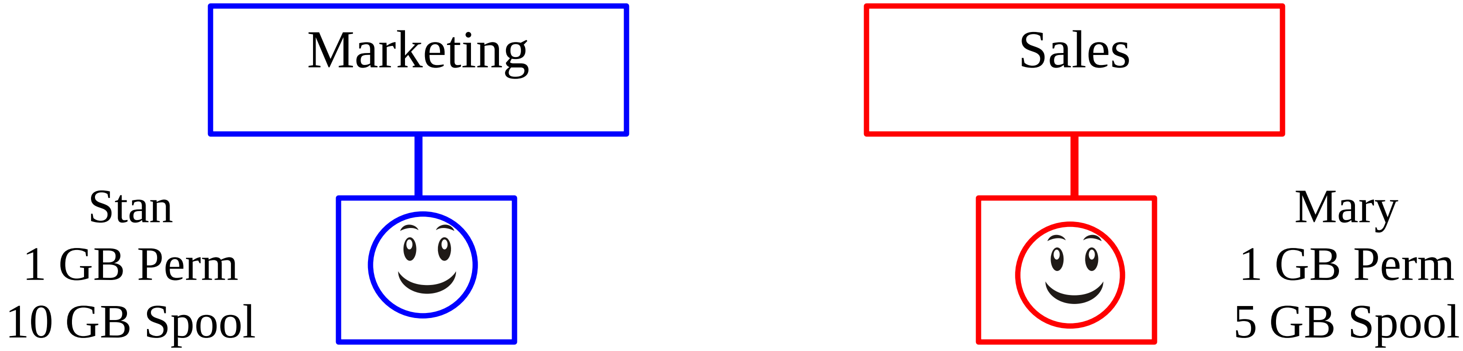
Marketing
10 GB Perm
10 GB Spool

Sales
5 GB Perm
5 GB Spool

1 Marketing has 10 GB of Perm and Spool. Sales has 5 GB Perm and Spool.

2 Marketing then Creates Stan and gives him 1 GB Perm and 10 GB Spool.

3 Sales then Creates Mary and gives her 1 GB Perm and 5 GB Spool.



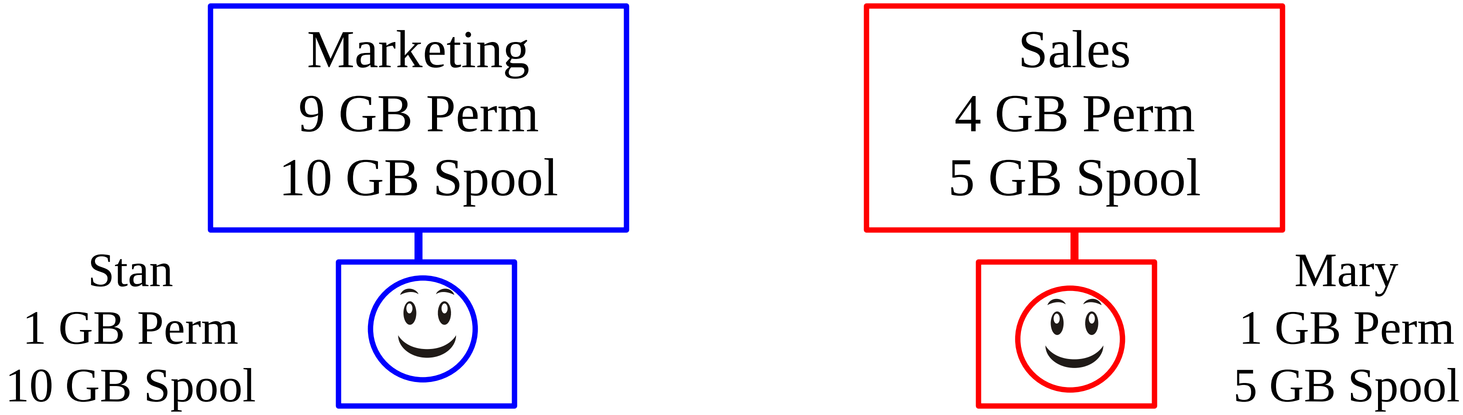
After creating users how much Perm / Spool is in Marketing and how much is in Sales?

9 GB Perm 10 GB Spool 4 GB Perm 5 GB Spool

Space Transfer Quiz

1 If a USER is dropped their PERM Space goes up to their immediate parent.

2 If a USER is transferred (GIVE Statement) they take their space with them.



Marketing
9 GB Perm
10 GB Spool

Stan
1 GB Perm
10 GB Spool

Sales
4 GB Perm
5 GB Spool

Mary
1 GB Perm
5 GB Spool

Stan has just been transferred to Sales.

After the transfer how much Perm / Spool is in:

Marketing ______________ ______________

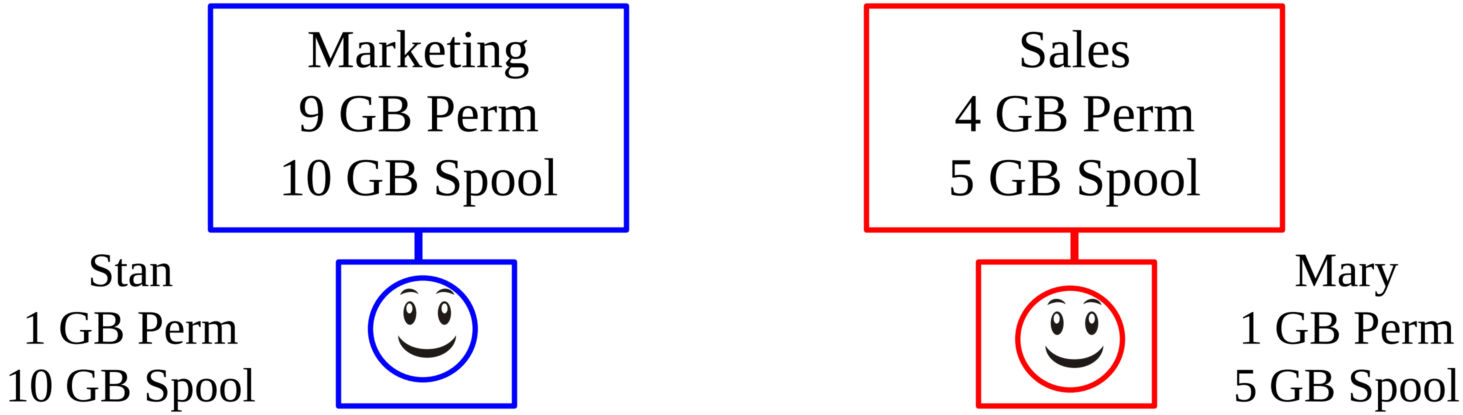
Sales ______________ ______________

Stan ______________ ______________

Answer to Space Transfer Quiz

1 If a USER is dropped their PERM Space goes up to their immediate parent.

2 If a USER is transferred (GIVE Statement) they take their space with them.



Marketing
9 GB Perm
10 GB Spool

Sales
4 GB Perm
5 GB Spool

Stan
1 GB Perm
10 GB Spool

Mary
1 GB Perm
5 GB Spool

Stan has just been transferred to Sales.

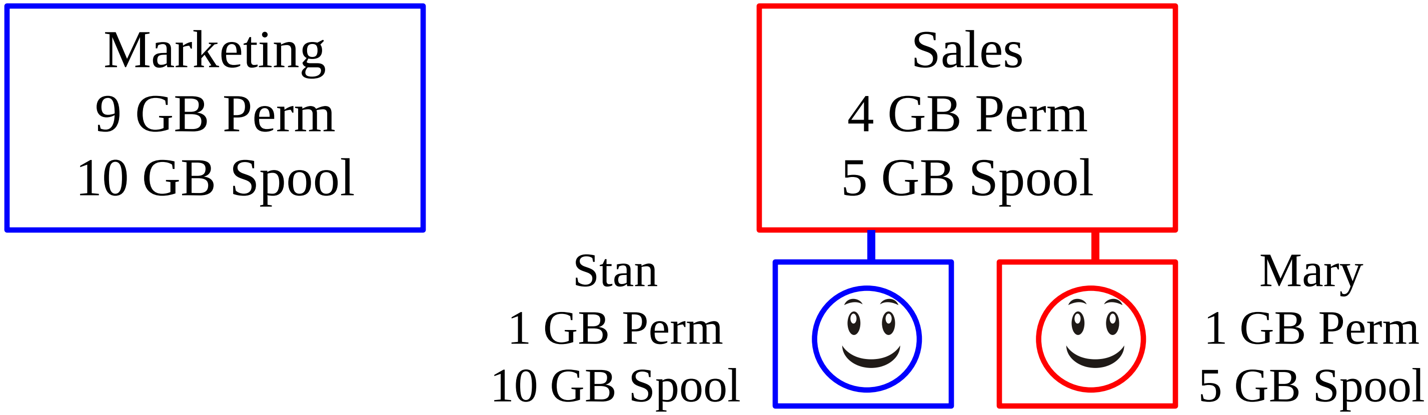
After the transfer how much Perm / Spool is in:

Marketing	9 GB Perm	10 GB Spool
Sales	4 GB Perm	5 GB Spool
Stan	1 GB Perm	10 GB Spool

Drop Space Quiz

1 If a USER is dropped their PERM Space goes up to their immediate parent.

2 If a USER is transferred (GIVE Statement) they take their space with them.



Marketing
9 GB Perm
10 GB Spool

Sales
4 GB Perm
5 GB Spool

Stan
1 GB Perm
10 GB Spool

Mary
1 GB Perm
5 GB Spool

What happens NOW if Stan is Dropped?

After the drop how much Perm / Spool is in:

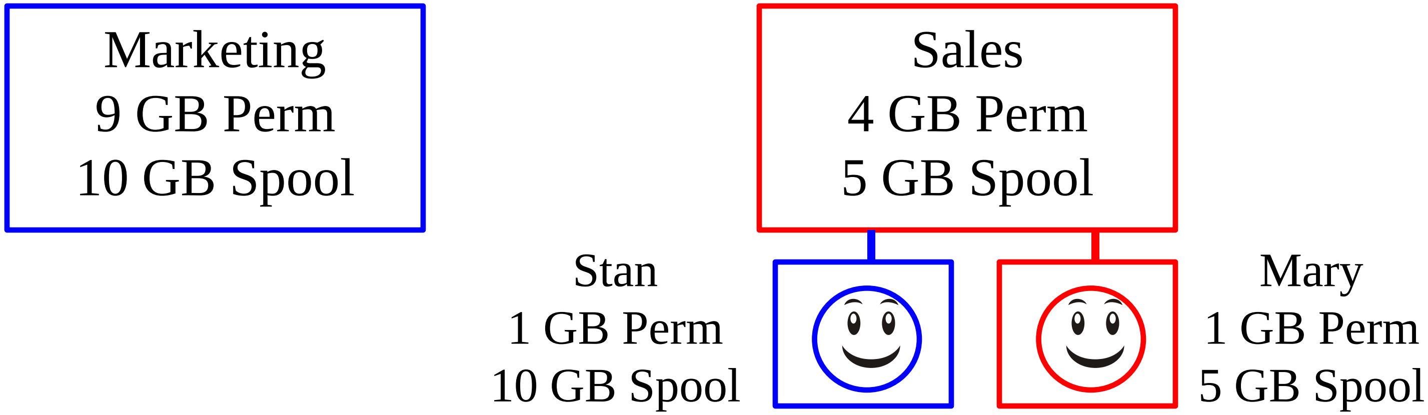
Marketing ______________ ______________

Sales ______________ ______________

Stan ______________ ______________

Answers to Drop Space Quiz

1. If a USER is dropped their PERM Space goes up to their immediate parent.
2. If a USER is transferred (GIVE Statement) they take their space with them.



Marketing
9 GB Perm
10 GB Spool

Sales
4 GB Perm
5 GB Spool

Stan
1 GB Perm
10 GB Spool

Mary
1 GB Perm
5 GB Spool

What happens NOW if Stan is Dropped?

After the drop how much Perm / Spool is in:

Marketing	9 GB Perm	10 GB Spool
Sales	5 GB Perm	5 GB Spool
Stan	dropped (0)	dropped (0)

Date Functions

“An inch of time cannot be bought with an inch of gold.”

- Chinese Proverb

Dates are stored Internally as INTEGERS from a Formula

INTEGERDATE = ((Year – 1900) * 10000) + (Month * 100) + Day

/* Example – Tom’s Birthday January 10, 1959 */

INTEGERDATE = ((1959 – 1900) = 59 ← Year Portion
* 10000) = 590000
+ (Month * 100) = 590100 ← Month Portion
+ Day = 590110 ← Day Portion

/* Example – Tom’s Birthday January 10, 1999 */

990110

/* Example – Tom’s Birthday January 10, 2000 */

1000110

The way the Smart Calendar works so well is that it stores EVERY date in Teradata as something known as an INTEGERDATE.

Date, Time, and Timestamp Keywords

```
SELECT Date                           AS "Date"
          ,Current_Date               AS ANSI_Date
          ,Time                       AS "Time"
          ,Current_Time               AS ANSI_Time
          ,Current_Timestamp(6)       AS ANSI_Timestamp
```

Answer Set

```
Date          ANSI_Date     Time        ANSI_Time     ANSI_Timestamp
2011/03/22    2011/03/22    10:34:44    10:34:44      2011/03/22 10:34:44.123456 -04:00
```

There's no keyword Timestamp, but only ANSI's Current_Timestamp

Above are the keywords you can utilize to get the date, time, or timestamp. These are reserved words that the system will deliver to you when requested.

INTEGER Date Vs ANSIDATE is how the Date is Displayed

```
SELECT Date                     AS "Date"
          ,Current_Date         AS ANSI_Date
```

INTEGERDATE (YY/MM/DD)

June 30, 2012

```
Date              ANSI_Date
_________        __________
12/06/30           12/06/30
```

ANSIDATE (YYYY-MM-DD)

June 30, 2012

```
Date              ANSI_Date
_________        __________
2012-06-30       2012-06-30
```

NEXUS Query Chameleon MM-DD-YYYY

```
Date              ANSI_Date
_________        __________
06-30-2012       06-30-2012
```

Teradata in release V2R3 defaulted to a display of YY/MM/DD. This is called the INTEGERDATE. This can be changed to ANSIDATE, which is YYYY-MM-DD for a specific session or by Default if the DBA changes the DATEFORM in DBS Control. This has nothing to do with how the date is stored internally. It has to do with the display of dates when using any ODBC tool or load utility. Above are some examples.

DATEFORM

DATEFORM Controls the default display of dates.

DATEFORM display choices are either INTEGERDATE or ANSIDATE.

INTEGERDATE is (YY/MM/DD) and ANSIDATE is (YYYY-MM-DD).

DATEFORM is the expected format for import and export of dates in Load Utilities.

Can be over-ridden by USER or within a Session at any time.

The Default can be changed by the DBA by changing the DATEFORM in DBSControl.

INTEGERDATE (YY/MM/DD)

June 30, 2012

```
Date              ANSI_Date
__________      ___________
12/06/30           12/06/30
```

ANSIDATE (YYYY-MM-DD)

June 30, 2012

```
Date              ANSI_Date
__________      ___________
2012-06-30       2012-06-30
```

Teradata in release V2R3 defaulted to a display of YY/MM/DD. This is called the INTEGERDATE. This can be changed to ANSIDATE, which is YYYY-MM-DD for a specific session or by Default if the DBA changes the DATEFORM in DBS Control. This has nothing to do with how the date is stored internally. It has to do with the display of dates when using any ODBC tool or load utility.

Changing the DATEFORM in Client Utilities such as BTEQ

```
Enter your logon or BTEQ Command:
.logon localtd/dbc
Password: ************
Logon successfully completed
BTEQ – Enter your DBC/SQL request or BTEQ command:

SELECT DATE;


      Date
------------
12/06/30

BTEQ – Enter your DBC/SQL request or BTEQ command:

SET Session DATEFORM = ANSIDATE;

SELECT DATE;

Current Date
----------------
2012-06-30
```

Notice the Word Date

INTEGERDATE is the Default

Changing the DATEFORM for this BTEQ session.

Notice the Word Current_Date

ANSIDATE is the Display Form

Date, Time, and Timestamp Recap

```
SELECT Date                   AS “Date”
          ,Current_Date       AS ANSI_Date
```

INTEGERDATE (YY/MM/DD)

June 30, 2012

```
Date              ANSI_Date
__________        ___________
12/06/30            12/06/30
```

ANSIDATE (YYYY-MM-DD)

June 30, 2012

```
Date              ANSI_Date
__________        ___________
2012-06-30        2012-06-30
```

Dates are converted to an integer through a formula before being stored.

Dates are displayed by default as INTEGERDATE YY-MM-DD.

The DBA can set up the system to display as ANSIDATE YYYY-MM-DD.

Keywords Date or Current_Date will return the date automatically.

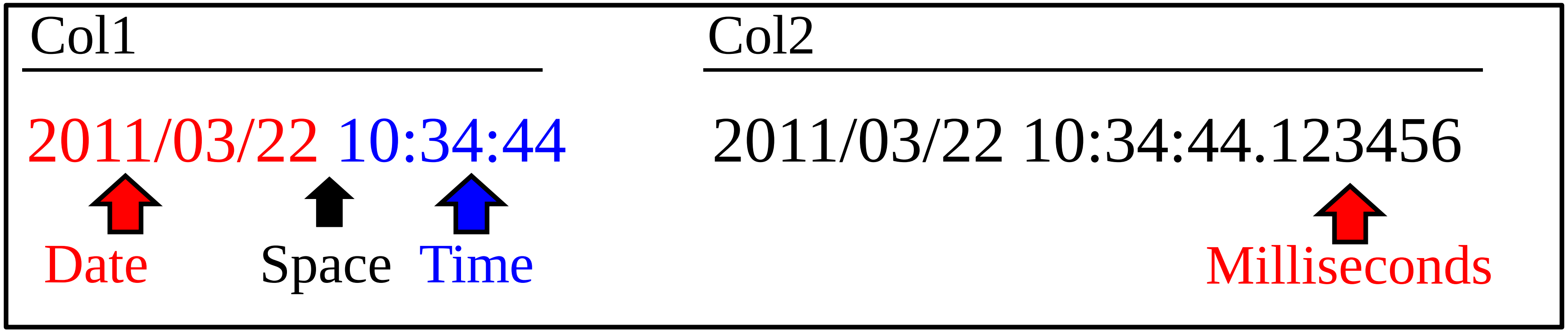
Time, Current_Time and Current_Timestamp are keywords.

The Nexus Query Chameleon displays dates as MM-DD-YYYY.

Timestamp Differences

```
SELECT Current_Timestamp(0)   AS Col1
           ,Current_Timestamp(6)   AS Col2
```

Answer Set



```
Col1                                  Col2
_______________________               ______________________________

2011/03/22 10:34:44                   2011/03/22 10:34:44.123456
```

Date

Space

Time

Milliseconds

A timestamp has the date separated by a space and the time. In our second example we have asked for 6 milliseconds.

Troubleshooting Timestamp

```
SELECT Timestamp(0)   AS Col1
            , Timestamp(6)   AS Col2
```

Error

There is Date and Current_Date (both work).

There is Time and Current_Time (both work).

There is NO Timestamp, but only Current_Timestamp!

There is NO Timestamp command, but only ANSI’s Current_Timestamp!

Add or Subtract Days from a date

```
SELECT  Order_Date
            ,Order_Date + 60 as "Due Date"
            ,Order_Total
            ,"Due date" -10   as Discount
            ,Order_Total *.98  (FORMAT '$$$$,$$$.99', Title 'Discounted')
FROM     Order_Table
ORDER BY 1 ;
```

```
Order_Date    Due Date      Order_Total   Discount      Discounted
__________    __________    ___________   __________    __________
05/04/1998    07/03/1998       12347.53   06/23/1998      12100.57
01/01/1999    03/02/1999        8005.91   02/20/1999       7845.79
09/09/1999    11/08/1999       23454.84   10/29/1999      22985.74
10/01/1999    11/30/1999        5111.47   11/20/1999       5009.24
10/10/1999    12/09/1999       15231.62   11/29/1999      14926.98
```

When you add or subtract from a Date you are adding/subtracting Days

Because Dates are stored internally on disk as integers it makes it easy to add days to the calendar. In the query above we are adding 60 days to the Order_Date.

A Summary of Math Operations on Dates

1. DATE – DATE = Interval (days between dates)
2. DATE + or - Integer = Date

Let’s find the number of days Tera-Tom has been alive since his last birthday.

```
 SELECT (1120110(date)) - (590110 (date))  (Title ‘Tera-Tom’’s Age In Days’);

Tera-Tom’s Age In Days
______________________
                 19358
```

Below is the same exact query, but with a clearer example of the dates.

```
SELECT ('1959-01-10'(date)) - ('2012-01-10' (date))  (Title 'Tera-Tom''s Age In Days');

 Tera-Tom’s Age In Days
 ______________________
                  19358
```

A DATE – DATE is an interval of days between dates. A DATE + or – Integer = Date. Both queries above perform the same function, but the top query uses the internal date functions and the query on the bottom does dates the traditional way.

Using a Math Operation to find your Age in Years

1. DATE – DATE = Interval (days between dates)
2. DATE + or - Integer = Date

Let’s find the number of days Tera-Tom has been alive since his last birthday.

```
SELECT (1120110(date)) - (590110 (date))  (Title ‘Tera-Tom’’s Age In Days’);
```

```
Tera-Tom’s Age In Days
______________________
                 19358
```

Let’s find the number of years Tera-Tom has been alive since his last birthday.

```
SELECT ((1120110(date)) - (590110 (date))) / 365 (Title 'Tera-Tom''s Age In Years');
```

```
Tera-Tom’s Age In Years
______________________
                    53
```

A DATE – DATE is an interval of days between dates. A DATE + or – Integer = Date. Both queries above perform the same function, but the top query uses the internal date functions and the query on the bottom does dates the traditional way.

Find What Day of the week you were Born

Let’s find the actual day of the week Tera-Tom was born

```
SEL ‘Tera-Tom was born on day ’ || ((590110(date)) - (101(date))) MOD 7  (TITLE ‘ ’);
```

```
Tera-Tom was born on day        5
```

This will produce
No Title

Result	Day of the Week
0	Monday
1	Tuesday
2	Wednesday
3	Thursday
4	Friday
5	Saturday
6	Sunday

This chart can be used
In conjunction with the
above SQL

The above subtraction results in the number of days between the two dates. Then, the MOD 7 divides by 7 to get rid of the number of weeks and results in the remainder. A MOD 7 can only result in values 0 thru 6 (always 1 less than the MOD operator). Since January 1, 1900 (101(date)) is a Monday, Tom was born on a Saturday.

The ADD_MONTHS Command

Order_Table

Order_Number	Customer_Number	Order_Date	Order_Total
123456	11111111	12347.53	1998/05/04
123512	11111111	8005.91	1999/01/01
123552	31323134	5111.47	1999/10/01
123585	87323456	15231.62	1999/10/10
123777	57896883	23454.84	1999/09/09

```
SELECT Order_Date
            ,Add_Months (Order_Date,2)  as “Due Date”
            ,Order_Total
FROM     Order_Table ORDER BY 1 ;
```

Order_Date	Due Date	Order_Total
05/04/1998	07/04/1998	12347.53
01/01/1999	03/01/1999	8005.91
09/09/1999	11/09/1999	23454.84
10/01/1999	12/01/1999	5111.47
10/10/1999	12/10/1999	15231.62

This is the Add_Months Command. What you can do with it is add a month or many months your columns date.   Can you convert this to one year?

Using the ADD_MONTHS Command to Add 1-Year

Order_Table

Order_Number	Customer_Number	Order_Date	Order_Total
123456	11111111	12347.53	1998/05/04
123512	11111111	8005.91	1999/01/01
123552	31323134	5111.47	1999/10/01
123585	87323456	15231.62	1999/10/10
123777	57896883	23454.84	1999/09/09

```
SELECT Order_Date
            ,Add_Months (Order_Date,12)  as “Due Date”
            ,Order_Total
FROM      Order_Table
ORDER BY 1 ;
```

There is no Add_Year command, so put in 12 months for 1-year

The Add_Months command adds months to any date. Above we used a great technique that would give us 1-year. Can you give me 5-years?

Using the ADD_MONTHS Command to Add 5-Years

Order_Table

Order_Number	Customer_Number	Order_Date	Order_Total
123456	11111111	12347.53	1998/05/04
123512	11111111	8005.91	1999/01/01
123552	31323134	5111.47	1999/10/01
123585	87323456	15231.62	1999/10/10
123777	57896883	23454.84	1999/09/09

```
SELECT Order_Date
            ,Add_Months (Order_Date,12 * 5)  as “Due Date”
            ,Order_Total
FROM     Order_Table
ORDER BY 1 ;
```

In this example we multiplied 12 months times 5 for a total of 5 years!

Above you see a great technique for adding multiple years to a date. Can you now SELECT only the orders in September?

The EXTRACT Command

Order_Table

Order_Number	Customer_Number	Order_Date	Order_Total
123456	11111111	12347.53	1998/05/04
123512	11111111	8005.91	1999/01/01
123552	31323134	5111.47	1999/10/01
123585	87323456	15231.62	1999/10/10
123777	57896883	23454.84	1999/09/09

```
SELECT Order_Date
              ,Add_Months (Order_Date,12 * 5)  as “Due Date”
              ,Order_Total
FROM      Order_Table
WHERE  EXTRACT(Month from Order_Date) = 09
ORDER BY 1 ;
```

The EXTRACT command extracts portions of Date, Time, and Timestamp.

This is the Extract command. It extracts a portion of the date and it can be used in the SELECT list or the WHERE Clause, or the ORDER BY Clause!

EXTRACT from DATES and TIME

```
SELECT Current_Date
            ,EXTRACT(Year from Current_Date) as Yr
            ,EXTRACT(Month from Current_Date) as Mo
            ,EXTRACT(Day from Current_Date) as Da
            ,Current_Time
            ,EXTRACT(Hour from Current_Time) as Hr
            ,EXTRACT(Minute from Current_Time) as Mn
            ,EXTRACT(Second from Current_Time) as Sc
            ,EXTRACT(TIMEZONE_HOUR from Current_Time) as Th
            ,EXTRACT(TimeZONE_MINUTE from Current_Time) as Tm
```

Answer Set

```
Order_Date    Yr      Mo    Day    Current_Time (0)   Hr   Mn    Sc   Th   Tm
 2011/03/22   2011     03    22         20:01:14 20    1    14    0    0    0
```

Just like the Add_Months, the EXTRACT Command is a Temporal Function or a Time-Based Function.

CURRENT_DATE and Math to get Temporal Functions

```
SELECT Current_Date
          ,EXTRACT(Year from Current_Date) as Yr
          ,EXTRACT(Month from Current_Date) as Mo
          ,EXTRACT(Day from Current_Date) as Da
          ,Current_Date / 10000 +1900 as YrMath
          ,(Current_Date  / 100) Mod 100 as MoMath
          ,Current_Date Mod 100 as DayMath ;
```

Math can be used to extract portions of a Date!

Answer Set

```
 Order_Date     Yr       Mo    Day    YrMath  MoMath   DayMath
   2011/03/22   2011     03     22     2011        03       22
```

The Extract Temporal Function can be used to extract a portion of a date. As you can see, Basic Arithmetic accomplish the same thing.

CAST the Date of January 1, 2011 and the Year 1800

```
SELECT
 cast('2011-01-01' as date)    as ANSI_Literal
,cast(1110101 as date)        as INTEGER_Literal
,cast('11-01-01' as date)      as YY_Literal
,cast(Date '2011-01-01' as Integer) as Dates_Stored
,cast(Date '1800-01-01' as Integer) as Dates_1800s
```

Answer Set

```
ANSI_Literal  INTEGER_Literal  YY_Literal    Dates_Stored   Dates_1800s
____________  _______________  __________    ____________   ___________
01/01/2011    01/01/2011       01/01/1911          111010        -999899
```

The Convert And Store (CAST) command is used to give columns a different data type temporarily for the life of the query. Notice our dates and how their stored.

The System Calendar

Teradata systems have a table called Caldates.

Caldates has only one column in it called Cdates.

Cdates is a date column that contains a row for each date starting from January 1, 1900 to December 31, 2100.

No user can access the table Caldates directly.

Views in the Sys_Calendar database accesses Caldates.

A view called Calendar is how USER's work with the calendar.

Users use Sys_Calendar.Calendar for advanced dates.

In every Teradata system, they have something known as a System Calendar (or as Teradata calls it Sys_Calendar.Calendar). Get ready for AWESOME!

```
SELECT *  FROM Sys_Calendar.Calendar
WHERE Calendar_Date = ‘1959-01-10’ ;
```

Birthday of
Tera-Tom

```
Calendar_Date = 01/10/1959'
day_of_week  = 7 (Sunday = 1)
day_of_month  = 10
day_of_year  = 10
day_of_Calendar  = 21559 (since Jan 1, 1900)
weekday_of_month  = 2
week_of_month  = 1 (0 for partial week for any month not starting with Sunday)
week_of_year  = 1
week_of_calendar  = 3079 (since Jan 1, 1900)
month_of_quarter  = 1
month_of_year  = 1
month_of_calendar   = 709 (since Jan 1, 1900)
quarter_of_year    = 1
quarter_of_calender  =  237 (since Jan 1, 1900)
year_of_calendar   = 1959
```

Tera-Tom was born on a Saturday! It was the first full week of the month, the first full week of the year and it was the first quarter of the year!

How to really use the Sys_Calendar.Calendar

```
SELECT O.*
FROM Order_Table as O
INNER JOIN
          Sys_Calendar.Calendar
ON Order_Date = Calendar_Date
AND Quarter_Of_Year = 4
AND Day_of_Week = 6
AND Week_of_Month = 0;
```

Join a date column with the Calendar_Date

```
Order_Number    Customer_Number    Order_Date    Order_Total
____________    _______________    __________    ___________
      123552           31323134    10/01/1999        5111.47
```

We just brought back all Orders from the Order_Table that were purchased on a Friday in the 4th Quarter, during the 1st partial week. This means no Sunday seen yet for that month.

Above is the perfect example of how you can utilize the Sys_Calendar.Calendar to join to any date field and then expand your search options.

Storing Dates Internally

```
CREATE SET TABLE TIMEZONE_table ,FALLBACK ,
    NO BEFORE JOURNAL,
    NO AFTER JOURNAL ,
CHECKSUM = DEFAULT
    (Date_col                   Date,
     TIME_col                   TIME(6),
     TIMETIMEZONE_col           TIME(6) WITH TIME ZONE,
     TIMESTAMP_col              TIMESTAMP(6),
     TIMEZONE_col               TIMESTAMP(6) WITH TIME ZONE)
UNIQUE PRIMARY INDEX ( TIMEZONE_col );
```

DATE ‘1999-01-10’ is stored as 990110

DATE ‘2000-01-10’ is stored as 1000110

4-bytes store Date_col internally because dates are considered a 4-byte integer.

Storing Time Internally

```
CREATE SET TABLE TIMEZONE_table ,FALLBACK ,
     NO BEFORE JOURNAL,
     NO AFTER JOURNAL,
CHECKSUM = DEFAULT
     (Date_col                    Date,
      TIME_col                    TIME(6),
      TIMETIMEZONE_col            TIME(6) WITH TIME ZONE,
      TIMESTAMP_col               TIMESTAMP(6),
      TIMEZONE_col                TIMESTAMP(6) WITH TIME ZONE)
UNIQUE PRIMARY INDEX  ( TIMEZONE_col );
```

Time(n) stored as HHMMSS.nnnnnn

It takes 6 bytes to store Time_col internally.

Storing TIME With TIME ZONE Internally

```
CREATE SET TABLE TIMEZONE_table ,FALLBACK ,
    NO BEFORE JOURNAL,
    NO AFTER JOURNAL ,
CHECKSUM = DEFAULT
    (Date_col                  Date,
     TIME_col                  TIME(6),
     TIMETIMEZONE_col          TIME(6) WITH TIME ZONE,
     TIMESTAMP_col             TIMESTAMP(6),
     TIMEZONE_col              TIMESTAMP(6) WITH TIME ZONE)
UNIQUE PRIMARY INDEX  ( TIMEZONE_col );
```

Time(n) WITH ZONE stored as HHMMSS.nnnnnn+HHMM

It takes 8 bytes to store TimeTimezone_col internally.

Storing Timestamp Internally

```
CREATE SET TABLE TIMEZONE_table ,FALLBACK ,
    NO BEFORE JOURNAL,
    NO AFTER JOURNAL ,
CHECKSUM = DEFAULT
    (Date_col                    Date,
     TIME_col                    TIME(6),
     TIMETIMEZONE_col            TIME(6) WITH TIME ZONE,
     TIMESTAMP_col               TIMESTAMP(6),
     TIMEZONE_col                TIMESTAMP(6) WITH TIME ZONE)
UNIQUE PRIMARY INDEX  ( TIMEZONE_col );
```

TimeStamp(n) stored as YYMMDDHHMMSS.nnnnnn

It takes **10 bytes** to store TimeStamp_col internally.

Storing Timestamp with TIME ZONE Internally

```
CREATE SET TABLE TIMEZONE_table ,FALLBACK ,
     NO BEFORE JOURNAL,
     NO AFTER JOURNAL ,
CHECKSUM = DEFAULT
     (Date_col                          Date,
      TIME_col                          TIME(6),
      TIMETIMEZONE_col      TIME(6) WITH TIME ZONE,
      TIMESTAMP_col            TIMESTAMP(6),
      TIMEZONE_col              TIMESTAMP(6) WITH TIME ZONE)
UNIQUE PRIMARY INDEX  ( TIMEZONE_col );
```

TimeStamp(n) With Zone stored as
YYMMDDHHMMSS.nnnnnn+HHMM

It will take 12 bytes to store Timezone_col internally.

Storing Date, Time, Timestamp with Zone Internally

```
CREATE SET TABLE TIMEZONE_table ,FALLBACK ,
    NO BEFORE JOURNAL,
    NO AFTER JOURNAL ,
CHECKSUM = DEFAULT
    (Date_col                  Date,
     TIME_col                  TIME(6),
     TIMETIMEZONE_col          TIME(6) WITH TIME ZONE,
     TIMESTAMP_col             TIMESTAMP(6),
     TIMEZONE_col              TIMESTAMP(6) WITH TIME ZONE)
UNIQUE PRIMARY INDEX  ( TIMEZONE_col );
```

Date	Stored Internally	4 Bytes
Time(n)	Stored Internally	6 Bytes
Time(n) With Zone	Stored Internally	8 Bytes
Timestamp(n)	Stored Internally	10 Bytes
Timestamp(n) with zone	Stored Internally	12 Bytes

Each data type increase their internal storage by 2 bytes.

Time Zones

A time zone relative to London (UTC) might be:

LA----------Miami-----------Frankfurt------------Hong Kong
+8:00 +05:00 00:00 -08:00

A time zone relative to New York (EST) might be:

LA----------Miami-----------Frankfurt------------Hong Kong
+3:00 00:00 -05:00 -13:00

Time zones are set either at the system level (DBS Control), the user level (when user is created or modified), or at the session level as an override.

Teradata has the ability to access and store both the hours and the minutes reflecting the difference between the user's time zone and the system time zone. From a World perspective, this difference is normally the number of hours between a specific location on Earth and the United Kingdom location that was historically called Greenwich Mean Time (GMT). Since the Greenwich observatory has been "decommissioned," the new reference to this same time zone is called Universal Time Coordinate (UTC).

Setting Time Zones

A Time Zone should be established for the system and every user in each different time zone.

Setting the system default time zone is done by the DBA in the DBSControl record:

```
MODIFY GENERAL 16 = x     /*  Hours,    n= -12 to 13    */
MODIFY GENERAL 17 = x     /*  Minutes, n = -59 to 59   */
```

Setting a User’s time zone requires choosing either LOCAL, NULL, or an explicit value:

```
CREATE USER   Tera-Tom
TIME ZONE      =  LOCAL   /* use system level         */
               =  NULL    /* no default, set to system or session level at logon */
               =  ‘16:00’ /* explicit setting         */
               = -‘06:30’ /* explicit setting         */
```

Setting a Session’s time zone:

```
SET TIME ZONE  LOCAL ;  /*    use system level    */
SET TIME ZONE  USER ;   /*    use user level      */
SET TIME ZONE INTERVAL ‘08:00’ HOUR TO MINUTE ;   /*  explicit setting    */
```

A Teradata session can modify the time zone without requiring a logoff and logon

Seeing your Time Zone

```
Help Session ;

User   Account  Logon     Logon     Current      Collation  Char   Transaction  Current      Session
Name   Name     Date      Time      Database                Set    Semantics    Dateform     Time Zone
____   _______  ________  ________  ___________  _________  _____  ___________  ___________  _________

DBC    DBC      12/06/17  15:55:39  SQL_CLASS    ASCII      ASCII  Teradata     IntegerDate  00:00
```

Not all output is displayed above from the HELP Session

A user’s time zone is now part of the information maintained by Teradata. The settings can be seen in the extended information available in the HELP SESSION request. Teradata converts all TIME and TIMESTAMP values to Universal Time Coordinate (UTC) prior to storing them. All operations, including hashing, collation, and comparisons that act on TIME and TIMESTAMP values are performed using their UTC forms. This will allow users to CAST the information to their local times.

Creating a Sample Table for Time Zone Examples

```
CREATE TABLE Tstamp_Test
 (
    TS_Zone CHAR(3)
   ,TS_with_Zone TIMESTAMP(6) WITH TIME ZONE
   ,TS_Without_Zone TIMESTAMP(6)
 )
UNIQUE PRIMARY INDEX ( TS_Zone );
```

Not all output is displayed above from the HELP Session

A user's time zone is now part of the information maintained by Teradata. The settings can be seen in the extended information available in the HELP SESSION request.

Inserting Rows in the Sample Table for Time Zone Examples

```
Enter your logon or BTEQ Command:
.logon localtd/dbc
Password: ************
Logon successfully completed
BTEQ – Enter your DBC/SQL request or BTEQ command:

          INSERT INTO Tstamp_Test ('EST', timestamp '2000-10-01 08:12:00',
                                          timestamp '2000-10-01 08:12:00');

SET TIME ZONE INTERVAL ‘05:00’ HOUR TO MINUTE ;
         INSERT INTO Tstamp_Test ('UTC', timestamp '2000-10-01 08:12:00',
                                          timestamp '2000-10-01 08:12:00');

SET TIME ZONE INTERVAL -‘03:00’ HOUR TO MINUTE ;
         INSERT INTO Tstamp_Test ('PST', timestamp '2000-10-01 08:12:00',
                                         timestamp '2000-10-01 08:12:00');

SET TIME ZONE INTERVAL -‘11:00’ HOUR TO MINUTE ;
         INSERT INTO Tstamp_Test ('HKT', timestamp '2000-10-01 08:12:00',
                                          timestamp '2000-10-01 08:12:00');
```

Selecting the Data from our Time Zone Table

```
SELECT * FROM Tstamp_Test ;
```

```
TS_Zone     TS_with_Zone                            TS_Without_Zone
_______     ____________________________________    ____________________________

  UTC       2000-10-01 08:12:00.000000+05:00        2000-10-01 08:12:00.000000
  EST       2000-10-01 08:12:00.000000+00:00        2000-10-01 08:12:00.000000
  PST       2000-10-01 08:12:00.000000-03:00        2000-10-01 08:12:00.000000
  HKT       2000-10-01 08:12:00.000000-11:00        2000-10-01 08:12:00.000000
```

Notice the
Accompanying
Time Zone Offsets

Our Insert statements were done at 08:12:00 exactly. Notice the Time Zone offsets in the column TS_with_Zone and how their not there for the column TS_Without_Zone. Teradata converts all TIME and TIMESTAMP values to Universal Time Coordinate (UTC) prior to storing them. All operations, including hashing, collation, and comparisons that act on TIME and TIMESTAMP values are performed using their UTC forms. This will allow users to CAST the information to their local times.

Normalizing our Time Zone Table with a CAST

```
SELECT TS_Zone, TS_with_Zone
              ,CAST(TS_with_Zone AS TIMESTAMP(6))  AS T_Normal
FROM Tstamp_Test   ORDER BY 3 ;
```

```
TS_Zone    TS_with_Zone                              T_Normal
_______    _________________________________         ___________________________

  UTC      2000-10-01 08:12:00.000000+05:00          2000-10-01 03:12:00.000000
  EST      2000-10-01 08:12:00.000000+00:00          2000-10-01 08:12:00.000000
  PST      2000-10-01 08:12:00.000000-03:00          2000-10-01 11:12:00.000000
  HKT      2000-10-01 08:12:00.000000-11:00          2000-10-01 19:12:00.000000
```

The System is on EST Time. The New Times are Normalized to the time zone of the System!

Notice that the Time Zone value was added to or subtracted from the time portion of the time stamp to adjust them to a perspective of the same time zone. As a result, at that moment, it has normalized the different Times Zones in respect to the system time.

As an illustration, when the transaction occurred at 8:12 AM locally in the PST Time Zone, it was already 11:12 AM in EST, the location of the system. The times in the columns have been normalized in respect to the time zone of the system.

Intervals for Date, Time and Timestamp

Interval Chart

Simple Intervals	More involved Intervals
YEAR	DAY TO HOUR
MONTH	DAY TO MINUTE
DAY	DAY TO SECOND
HOUR	HOUR TO MINUTE
MINUTE	HOUR TO SECOND
SECOND	MINUTE TO SECOND

To make Teradata SQL more ANSI compliant and compatible with other RDBMS SQL, Teradata has added INTERVAL processing. Intervals are used to perform DATE, TIME and TIMESTAMP arithmetic and conversion.

Although Teradata allowed arithmetic on DATE and TIME, it was not performed in accordance to ANSI standards and therefore, an extension instead of a standard. With INTERVAL being a standard instead of an extension, more SQL can be ported directly from an ANSI compliant database to Teradata without conversion.

Interval Data Types and the Bytes to Store Them

Interval Chart

Bytes	Data Type	Comments
2	INTERVAL YEAR	
4	INTERVAL YEAR TO MONTH	
2	INTERVAL MONTH	
2	INTERVAL MONTH TO DAY	
2	INTERVAL DAY	
8	INTERVAL DAY TO MINUTE	
10/12	INTERVAL DAY TO SECOND	10 for 32-bit systems; 12 for 64-bit
2	INTERVAL HOUR 2	
4	INTERVAL HOUR TO MINUTE 4	
8	INTERVAL HOUR TO SECOND 8	
2	INTERVAL MINUTE 2	
6/8	INTERVAL MINUTE TO SECOND	6 for 32-bit systems; 8 for 64-bit
6/8	INTERVAL SECOND	6 for 32-bit systems; 8 for 64-bit

The Basics of a Simple Interval

```
SELECT Current_Date as Our_Date
          ,Current_Date + Interval '1' Day       as Plus_1_Day
          ,Current_Date + Interval '3' Month     as Plus_3_Months
          ,Current_Date + Interval '5' Year      as Plus_5_Years
```

```
Our_Date      Plus_1_Day      Plus_3_Months      Plus_5_Years
__________    ____________    _______________    ______________
06/18/2012    06/19/2012      09/18/2012         06/18/2017
```

In the example SQL above we take a simple date and add 1 day, 3 months and 5 years. Notice that our current_date is 06/18/2012 and that our intervals come out perfectly.

Troubleshooting The Basics of a Simple Interval

```
SELECT Date '2012-01-29' as Our_Date
              ,Date '2012-01-29' + INTERVAL '1' Month as Leap_Year
```

```
 Our_Date      Leap_Year
__________    ___________
01/29/2012    02/29/2012
```

```
SELECT Date '2011-01-29' as Our_Date
              ,Date '2011-01-29' + INTERVAL '1' Month as Leap_Year
```

Error – Invalid Date

The first example works because we added 1 month to the date ‘2012-01-29’ and we got ‘2012-02-29’. Because this was leap year there actually is a date of February 29, 2012. The next example is the real point. We have a date of ‘2011-01-29’ and we add 1-month to that, but there is no February 29th in 2011 so the query fails.

Interval Arithmetic Results

DATE and TIME arithmetic Results using intervals:

DATE	-	DATE	=	Interval
TIME	-	TIME	=	Interval
TIMESTAMP	-	TIMESTAMP	=	Interval
DATE	- or +	Interval	=	DATE
TIME	- or +	Interval	=	TIME
TIMESTAMP	- or +	Interval	=	TIMESTAMP
Interval	- or +	Interval	=	Interval

To use DATE and TIME arithmetic, it is important to keep in mind the results of various operations. The above chart is you Interval guide.

A Date Interval Example

```
SELECT (DATE '1999-10-01' - DATE '1988-10-01') DAY   AS Actual_Days ;
```

ERROR – Interval Field Overflow

The Error occurred because the default for all intervals is 2 digits.

```
SELECT (DATE '1999-10-01' - DATE '1988-10-01’) DAY(4)   AS Actual_Days ;
```

Makes the output 4 digits

```
Actual_Days
___________
4017
```

The default for all intervals is 2 digits. We received an overflow error because the Actual_Days is 4017. The second example works because we demanded the output to be 4 digits (the maximum for intervals).

A Time Interval Example

Makes the output 3 digits

```
SELECT  (TIME '12:45:01' - TIME '10:10:01') HOUR         AS Actual_Hours
       ,(TIME '12:45:01' - TIME '10:10:01') MINUTE(3)    AS Actual_Minutes
       ,(TIME '12:45:01' - TIME '10:10:01') SECOND(4)    AS Actual_Seconds
       ,(TIME '12:45:01' - TIME '10:10:01') SECOND(4,4) AS Actual_Seconds4
```

```
Actual_Hours    Actual_Minutes    Actual_Seconds    Actual_Seconds4
------------    --------------    --------------    ---------------
           2               155       9300.000000          9300.0000
```

```
SELECT  (TIME '12:45:01' - TIME '10:10:01') HOUR         AS Actual_Hours
       ,(TIME '12:45:01' - TIME '10:10:01') MINUTE       AS Actual_Minutes
       ,(TIME '12:45:01' - TIME '10:10:01') SECOND(4)    AS Actual_Seconds
       ,(TIME '12:45:01' - TIME '10:10:01') SECOND(4,4) AS Actual_Seconds4
```

ERROR – Interval Field Overflow

The default for all intervals is 2 digits, but notice in the top example we put in 3 digits for Minute, 4 digits for Second and 4,4 digits for the Acutal_Seconds4. If we had not we would have received an overflow error as in the bottom example.

A - DATE Interval Example

```
SELECT  Current_Date,
             INTERVAL -'2' YEAR + CURRENT_DATE as Two_years_Ago;
```

```
Date           Two_Year_Ago
__________     ____________
06/18/2012     06/18/2010
```

The above Interval example uses a –’2’ to go back in time.

A Complex Time Interval Example using CAST

Below is the syntax for using the CAST with a date:

```
SELECT CAST (<interval>  AS INTERVAL <interval> )
FROM  <table-name> ;
```

The following converts an INTERVAL of 6 years and 2 months to an INTERVAL number of months:

```
SELECT CAST( (INTERVAL '6-02' YEAR TO MONTH)  AS INTERVAL MONTH );
```

```
 6-02
-----
   74
```

The CAST function (Convert And Store) is the ANSI method for converting data from one type to another. It can also be used to convert one INTERVAL to another INTERVAL representation. Although the CAST is normally used in the SELECT list, it works in the WHERE clause for comparison reasons.

A Complex Time Interval Example using CAST

This request attempts to convert 1300 months to show the number of years and months. Why does it fail?

```
SELECT CAST(INTERVAL ‘1300’ MONTH AS INTERVAL YEAR TO MONTH)
(Title ‘Years & Months’) ;
```

ERROR

```
SELECT CAST(INTERVAL '1300' MONTH as interval YEAR(3) TO MONTH)  ;
```

```
Years & Month
-------------
 108-04
```

The top query failed because the INTERVAL result defaults to 2-digits and we have a 3-digit answer for the year portion (108). The bottom query fixes that specifying 3-digits. The biggest advantage in using the INTERVAL processing is that SQL written on another system is now compatible with Teradata.

The OVERLAPS Command

Compatibility: Teradata Extension

The syntax of the OVERLAPS is:

```
SELECT <literal>
            WHERE (<start-date-time>, <end-date-time>)    OVERLAPS
(<start-date-time>, <end-date-time>) ;
```

```
SELECT  'The Dates Overlap'   (TITLE ' ')
WHERE  (DATE '2001-01-01', DATE '2001-11-30')  OVERLAPS
                        (DATE '2001-10-15', DATE '2001-12-31');
```

Answer

The Dates Overlap

When working with dates and times, sometimes it is necessary to determine whether two different ranges have common points in time. Teradata provides a Boolean function to make this test for you. It is called OVERLAPS; it evaluates true, if multiple points are in common, otherwise it returns a false. The literal is returned because both date ranges have from October 15 through November 30 in common.

An OVERLAPS Example that Returns No Rows

```
SELECT  'The dates overlap'   (TITLE ' ')
WHERE  (DATE '2001-01-01', DATE '2001-11-30')  OVERLAPS
                         (DATE '2001-11-30', DATE '2001-12-31')  ;
```

Answer

```
No rows found
```

The above SELECT example tests two literal dates and uses the OVERLAPS to determine whether or not to display the character literal.

The literal was not selected because the ranges do not overlap. So, the common single date of November 30 does not constitute an overlap. When dates are used, 2 days must be involved and when time is used, 2 seconds must be contained in both ranges.

The OVERLAPS Command using TIME

```
SELECT  'The Times Overlap'   (TITLE ' ')
WHERE  (TIME '08:00:00', TIME '02:00:00')  OVERLAPS
                          (TIME '02:01:00', TIME '04:15:00')  ;
```

Answer

The Times Overlap

The above SELECT example tests two literal times and uses the OVERLAPS to determine whether or not to display the character literal.

This is a tricky example and it is shown to prove a point. At first glance, it appears as if this answer is incorrect because 02:01:00 looks like it starts 1 second after the first range ends. However, the system works on a 24-hour clock when a date and time (timestamp) is not used together. Therefore, the system considers the earlier time of 2AM time as the start and the later time of 8 AM as the end of the range. Therefore, not only do they overlap, the second range is entirely contained in the first range.

The OVERLAPS Command using a NULL Value

```
SELECT  'The Times Overlap'   (TITLE ' ')
WHERE  (TIME '10:00:00', NULL)  OVERLAPS  (TIME '01:01:00', TIME '04:15:00')
```

Answer → No Rows Found

The above SELECT example tests two literal dates and uses the OVERLAPS to determine whether or not to display the character literal:

When using the OVERLAPS function, there are a couple of situations to keep in mind:

1. A single point in time, i.e. the same date, does not constitute an overlap. There must be at least one second of time in common for TIME or one day when using DATE.
2. Using a NULL as one of the parameters, the other DATE or TIME constitutes a single point in time versus a range.

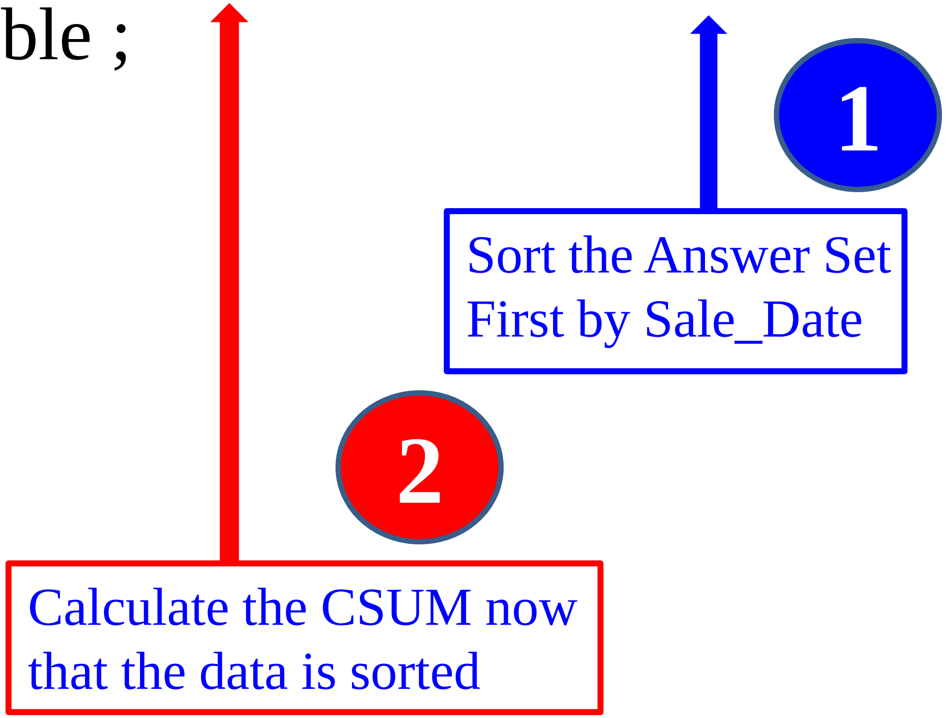
OLAP Functions

“The best we can do is size up the chances, calculate the risks involved, estimate our ability to deal with them, and then make our plans with confidence.”

- Henry Ford

On-Line Analytical Processing (OLAP) or Ordered Analytics

```
SELECT      Product_ID
           , Sale_Date
           , Daily_Sales
           ,CSUM(Daily_Sales, Sale_Date)   AS "CSum"
FROM  Sales_Table ;
```



1

Sort the Answer Set First by Sale_Date

2

Calculate the CSUM now that the data is sorted

OLAP is often called Ordered Analytics because the first thing every OLAP does before any calculating is SORT all the rows. The query above sorts by Sale_Date!

Cumulative Sum (CSUM) Command and how OLAP Works

```
SELECT      Product_ID , Sale_Date, Daily_Sales
           ,CSUM(Daily_Sales, Sale_Date)   AS “CSum”
FROM  Sales_Table ;
```

Product_ID	Sale_Date	Daily_Sales	CSUM
1000	2000-09-28	48850.40	
2000	2000-09-28	41888.88	
3000	2000-09-28	61301.77	
1000	2000-09-29	54500.22	
2000	2000-09-29	48000.00	
3000	2000-09-29	34509.13	
1000	2000-09-30	36000.07	
2000	2000-09-30	49850.03	
3000	2000-09-30	43868.86	
1000	2000-10-01	40200.43	
2000	2000-10-01	54850.29	
3000	2000-10-01	28000.00	
1000	2000-10-02	32800.50	
2000	2000-10-02	36021.93	
3000	2000-10-02	19678.94	

Not all rows are displayed in this answer set

1

Sort the Answer Set first by Sale_Date, but Don’t do any CSUM Calculations yet!

OLAP always sorts first and then is in a position to calculate starting with the first sorted row and continuing to the last sorted row, thus calculating all Daily_Sales.

OLAP Commands always Sort (ORDER BY) in the Command

```
SELECT      Product_ID , Sale_Date, Daily_Sales
            ,CSUM(Daily_Sales, Sale_Date)   AS "CSum"
FROM  Sales_Table ;
```

Product_ID	Sale_Date	Daily_Sales	CSUM
1000	2000-09-28	48850.40	48850.40
2000	2000-09-28	41888.88	**90739.28**
3000	2000-09-28	61301.77	152041.05
1000	2000-09-29	54500.22	206541.27
2000	2000-09-29	48000.00	254541.27
3000	2000-09-29	34509.13	289050.40
1000	2000-09-30	36000.07	325050.47
2000	2000-09-30	49850.03	374900.50
3000	2000-09-30	43868.86	418769.36
1000	2000-10-01	40200.43	458969.79
2000	2000-10-01	54850.29	513820.08
3000	2000-10-01	28000.00	541820.08
1000	2000-10-02	32800.50	574620.58

Not all rows are displayed in this answer set

2

Calculate the CSUM starting with the first sorted row and go to the last.

Once the data is first sorted by Sale_Date then phase 2 is ready and the OLAP calculation can be performed on the sorted data. Day 1 we made 48850.40! Add the next row's Daily_Sales to get a Cumulative Sum (CSUM) to get 90739.28!

Calculate the Cumulative Sum (CSUM) after Sorting the Data

```
SELECT    Product_ID , Sale_Date, Daily_Sales,
          CSUM(Daily_Sales, Sale_Date)   AS “CSUM”
FROM      Sales_Table WHERE Product_ID BETWEEN 1000 and 2000
```

Product_ID	Sale_Date	Daily_Sales	CSUM
2000	2000-09-28	41888.88	41888.88
1000	2000-09-28	48850.40	90739.28
2000	2000-09-29	48000.00	138739.28
1000	2000-09-29	54500.22	193239.50
1000	2000-09-30	36000.07	229239.57
2000	2000-09-30	49850.03	279089.60
1000	2000-10-01	40200.43	319290.03
2000	2000-10-01	54850.29	374140.32
1000	2000-10-02	32800.50	406940.82
2000	2000-10-02	36021.93	442962.75
1000	2000-10-03	64300.00	507262.75

Not all rows are displayed in this answer set

This is our first OLAP known as a CSUM. Right now, the syntax wants to see the cumulative sum of the Daily_Sales sorted by Sale_Date. The first thing the above query does before calculating is SORT all the rows on Sale_Date.

The OLAP Major Sort Key

```
SELECT Product_ID , Sale_Date, Daily_Sales,
           CSUM(Daily_Sales, Sale_Date)    AS “CSum”
FROM  Sales_Table WHERE Product_ID BETWEEN 1000 and 2000
```

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	CSum
2000	2000-09-28	41888.88	41888.88
1000	2000-09-28	48850.40	90739.28
2000	2000-09-29	48000.00	138739.28
1000	2000-09-29	54500.22	193239.50
1000	2000-09-30	36000.07	229239.57
2000	2000-09-30	49850.03	279089.60
1000	2000-10-01	40200.43	319290.03
2000	2000-10-01	54850.29	374140.32
1000	2000-10-02	32800.50	406940.82
2000	2000-10-02	36021.93	442962.75
1000	2000-10-03	64300.00	507262.75

In a CSUM, the second column listed is always the major SORT KEY. The SORT KEY in the above query is Sale_Date. Notice again the answer set is sorted by this. After the sort has finished the CSUM is calculated starting with the first sorted row till the end.

The OLAP Major Sort Key and the Minor Sort Key(s)

```
SELECT        Product_ID , Sale_Date, Daily_Sales,
           CSUM(Daily_Sales, Product_ID, Sale_Date)   AS "CSum"
FROM  Sales_Table;
```

Major
Sort Key

Minor
Sort Key

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	CSUM
1000	2000-09-28	48850.40	48850.40
1000	2000-09-29	54500.22	103350.62
1000	2000-09-30	36000.07	139350.69
1000	2000-10-01	40200.43	179551.12
1000	2000-10-02	32800.50	212351.62
1000	2000-10-03	64300.00	276651.62
1000	2000-10-04	54553.10	331204.72
2000	2000-09-28	41888.88	373093.60
2000	2000-09-29	48000.00	421093.60
2000	2000-09-30	49850.03	470943.63
2000	2000-10-01	54850.29	525793.92

Product_ID is the MAJOR sort key and Sale_Date is the MINOR Sort key above.

Troubleshooting OLAP – My Data isn’t coming back Correct

```
SELECT        Product_ID , Sale_Date, Daily_Sales,
           CSUM(Daily_Sales, Product_ID, Sale_Date)    AS “CSum”
FROM  Sales_Table WHERE Product_ID BETWEEN 1000 and 2000
ORDER BY Daily_Sales;
```

Don’t place an ORDER BY at the end!

Product_ID	Sale_Date	Daily_Sales	CSUM
1000	2000-10-02	32800.50	212351.62
2000	2000-10-04	32800.50	637816.53
1000	2000-09-30	36000.07	139350.69
2000	2000-10-02	36021.93	561815.85
1000	2000-10-01	40200.43	179551.12
2000	2000-09-28	41888.88	373093.60
2000	2000-10-03	43200.18	605016.03
2000	2000-09-29	48000.00	421093.60
1000	2000-09-28	48850.40	48850.40
2000	2000-09-30	49850.03	470943.63
1000	2000-09-29	54500.22	103350.62
1000	2000-10-04	54553.10	331204.72
2000	2000-10-01	54850.29	525793.92
1000	2000-10-03	64300.00	276651.62

The first thing every OLAP does is SORT. That means you should NEVER put an ORDER BY at the end. It will mess up the ENTIRE result set.

GROUP BY in Teradata OLAP Syntax Resets on the Group

```
SELECT        Product_ID , Sale_Date, Daily_Sales,
          CSUM(Daily_Sales, Product_ID, Sale_Date)    AS “CSum”
FROM  Sales_Table
GROUP BY Product_ID ;
```

Product_ID	Sale_Date	Daily_Sales	CSUM
1000	2000-09-28	48850.40	48850.40
1000	2000-09-29	54500.22	103350.62
1000	2000-09-30	36000.07	139350.69
1000	2000-10-01	40200.43	179551.12
1000	2000-10-02	32800.50	212351.62
1000	2000-10-03	64300.00	276651.62
1000	2000-10-04	54553.10	331204.72
2000	2000-09-28	**41888.88**	**41888.88**
2000	2000-09-29	48000.00	89888.88
2000	2000-09-30	49850.03	139738.91
2000	2000-10-01	54850.29	194589.20

Reset now!

Not all rows displayed In answer set

The GROUP BY Statement cause the CSUM to start over (reset) on its calculating the cumulative sum of the Daily_Sales each time it runs into a NEW Product_ID.

CSUM the Number 1 to get a Sequential Number

```
SELECT Product_ID , Sale_Date, Daily_Sales,
            CSUM(Daily_Sales, Product_ID, Sale_Date)    AS “CSum”,
            CSUM(1, Product_ID, Sale_Date) as “Seq_Number”
                              FROM  Sales_Table ;
```

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	CSUM	Seq_Number
1000	2000-09-28	48850.40	48850.40	1
1000	2000-09-29	54500.22	103350.62	2
1000	2000-09-30	36000.07	139350.69	3
1000	2000-10-01	40200.43	179551.12	4
1000	2000-10-02	32800.50	212351.62	5
1000	2000-10-03	64300.00	276651.62	6
1000	2000-10-04	54553.10	331204.72	7
2000	2000-09-28	41888.88	373093.60	8
2000	2000-09-29	48000.00	421093.60	9
2000	2000-09-30	49850.03	470943.63	10

With “Seq_Number”, because you placed the number 1 in the area where it calculates, it will continuously add 1 to the answer for each row.

A Single GROUP BY Resets each OLAP with Teradata Syntax

```
SELECT Product_ID , Sale_Date, Daily_Sales,
            CSUM(Daily_Sales, Product_ID, Sale_Date)    AS “CSum”,
            CSUM(1, Product_ID, Sale_Date) as “Seq_Number”
FROM  Sales_Table GROUP BY Product_ID ;
```

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	CSUM	Seq_Number
1000	2000-09-28	48850.40	48850.40	1
1000	2000-09-29	54500.22	103350.62	2
1000	2000-09-30	36000.07	139350.69	3
1000	2000-10-01	40200.43	179551.12	4
1000	2000-10-02	32800.50	212351.62	5
1000	2000-10-03	64300.00	276651.62	6
1000	2000-10-04	54553.10	331204.72	7
2000	2000-09-28	41888.88	41888.88	1
2000	2000-09-29	48000.00	89888.88	2
2000	2000-09-30	49850.03	139738.91	3
2000	2000-10-01	54850.29	194589.20	4

What does the GROUP BY Statement cause? Both OLAP Commands to reset!

A Better Choice – The ANSI Version of CSUM

```
SELECT Product_ID , Sale_Date, Daily_Sales,
       SUM(Daily_Sales) OVER (ORDER BY  Sale_Date
       ROWS UNBOUNDED PRECEDING)  AS SUMOVER
       FROM  Sales_Table
       WHERE Product_ID BETWEEN 1000 and 2000 ;
```

Start on 1st row and continue till the end

Not all rows are displayed in this answer set

```
Product_ID   Sale_Date    Daily_Sales        SUMOVER

      2000   2000-09-28      41888.88       41888.88
      1000   2000-09-28      48850.40       90739.28
      2000   2000-09-29      48000.00      138739.28
      1000   2000-09-29      54500.22      193239.50
      1000   2000-09-30      36000.07      229239.57
      2000   2000-09-30      49850.03      279089.60
      1000   2000-10-01      40200.43      319290.03
      2000   2000-10-01      54850.29      374140.32
      1000   2000-10-02      32800.50      406940.82
      2000   2000-10-02      36021.93      442962.75
```

This ANSI version of CSUM is SUM() Over. Right now, the syntax wants to see the sum of the Daily_Sales after it is first sorted by Sale_Date. Rows Unbounded Preceding makes this a CSUM. The ANSI Syntax seems difficult, but only at first.

The ANSI Version of CSUM – The Sort Explained

```
SELECT   Product_ID , Sale_Date, Daily_Sales,
         SUM(Daily_Sales) OVER (ORDER BY  Sale_Date
         ROWS UNBOUNDED PRECEDING)    AS SUMOVER
FROM  Sales_Table WHERE Product_ID BETWEEN 1000 and 2000 ;
```

Product_ID	Sale_Date	Daily_Sales	SUMOVER
2000	2000-09-28	41888.88	41888.88
1000	2000-09-28	48850.40	90739.28
2000	2000-09-29	48000.00	138739.28
1000	2000-09-29	54500.22	193239.50
1000	2000-09-30	36000.07	229239.57
2000	2000-09-30	49850.03	279089.60
1000	2000-10-01	40200.43	319290.03
2000	2000-10-01	54850.29	374140.32
1000	2000-10-02	32800.50	406940.82
2000	2000-10-02	36021.93	442962.75
1000	2000-10-03	64300.00	507262.75
2000	2000-10-03	43200.18	550462.93

Not all rows are displayed in this answer set

The first thing the above query does before calculating is SORT all the rows by Sale_Date. The Sort is located right after the ORDER BY.

The ANSI CSUM – Rows Unbounded Preceding Explained

```
SELECT    Product_ID , Sale_Date, Daily_Sales,
          SUM(Daily_Sales) OVER (ORDER BY  Sale_Date
          ROWS UNBOUNDED PRECEDING)    AS SUMOVER
FROM  Sales_Table WHERE Product_ID BETWEEN 1000 and 2000 ;
```

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	SUMOVER
2000	2000-09-28	41888.88	41888.88
1000	2000-09-28	48850.40	90739.28
2000	2000-09-29	48000.00	138739.28
1000	2000-09-29	54500.22	193239.50
1000	2000-09-30	36000.07	229239.57
2000	2000-09-30	49850.03	279089.60
1000	2000-10-01	40200.43	319290.03
2000	2000-10-01	54850.29	374140.32
1000	2000-10-02	32800.50	406940.82
2000	2000-10-02	36021.93	442962.75
1000	2000-10-03	64300.00	507262.75

The keywords Rows Unbounded Preceding determines that this is a CSUM. There are only a few different statements and Rows Unbounded Preceding is the main one. It means start calculating at the beginning row and continue calculating until the last row..

The ANSI CSUM – Making Sense of the Data

```
SELECT    Product_ID , Sale_Date, Daily_Sales,
          SUM(Daily_Sales) OVER (ORDER BY  Sale_Date
          ROWS UNBOUNDED PRECEDING)    AS SUMOVER
FROM  Sales_Table WHERE Product_ID BETWEEN 1000 and 2000 ;
```

Product_ID	Sale_Date	Daily_Sales	SUMOVER
2000	2000-09-28	**41888.88**	41888.88
1000	2000-09-28	**48850.40**	**90739.28**
2000	2000-09-29	48000.00	138739.28
1000	2000-09-29	54500.22	193239.50
1000	2000-09-30	36000.07	229239.57
2000	2000-09-30	49850.03	279089.60
1000	2000-10-01	40200.43	319290.03
2000	2000-10-01	54850.29	374140.32
1000	2000-10-02	32800.50	406940.82
2000	2000-10-02	36021.93	442962.75
1000	2000-10-03	64300.00	507262.75

Not all rows are displayed in this answer set

The second "SUMOVER" row is 90739.28. That is derived by the first row's Daily_Sales (41888.88) added to the SECOND row's Daily_Sales (48850.40).

The ANSI CSUM – Making Even More Sense of the Data

```
SELECT    Product_ID , Sale_Date, Daily_Sales,
          SUM(Daily_Sales) OVER (ORDER BY  Sale_Date
          ROWS UNBOUNDED PRECEDING)    AS SUMOVER
FROM  Sales_Table WHERE Product_ID BETWEEN 1000 and 2000 ;
```

Product_ID	Sale_Date	Daily_Sales	SUMOVER
2000	2000-09-28	**41888.88**	41888.88
1000	2000-09-28	**48850.40**	90739.28
2000	2000-09-29	**48000.00**	**138739.28**
1000	2000-09-29	54500.22	193239.50
1000	2000-09-30	36000.07	229239.57
2000	2000-09-30	49850.03	279089.60
1000	2000-10-01	40200.43	319290.03
2000	2000-10-01	54850.29	374140.32
1000	2000-10-02	32800.50	406940.82
2000	2000-10-02	36021.93	442962.75
1000	2000-10-03	64300.00	507262.75

Not all rows are displayed in this answer set

The third “SUMOVER” row is 138739.28. That is derived by taking the first row’s Daily_Sales (41888.88) and adding it to the SECOND row’s Daily_Sales (48850.40). Then you add that total to the THIRD row’s Daily_Sales (48000.00).

The ANSI CSUM – The Major and Minor Sort Key(s)

```
SELECT Product_ID , Sale_Date, Daily_Sales,
      SUM(Daily_Sales) OVER (ORDER BY  Product_ID, Sale_Date
      ROWS UNBOUNDED PRECEDING)    AS SumOVER
FROM  Sales_Table ;
```

```
Product_ID   Sale_Date    Daily_Sales       SUMOVER

      1000   2000-09-28      48850.40      48850.40
      1000   2000-09-29      54500.22     103350.62
      1000   2000-09-30      36000.07     139350.69
      1000   2000-10-01      40200.43     179551.12
      1000   2000-10-02      32800.50     212351.62
      1000   2000-10-03      64300.00     276651.62
      1000   2000-10-04      54553.10     331204.72
      2000   2000-09-28      41888.88     373093.60
      2000   2000-09-29      48000.00     421093.60
      2000   2000-09-30      49850.03     470943.63
      2000   2000-10-01      54850.29     525793.92
```

Not all rows
are displayed in
this answer set

You can have more than one SORT KEY. In the top query, Product_ID is the MAJOR Sort and Sale_Date is the MINOR Sort.

The ANSI CSUM – Getting a Sequential Number

```
SELECT Product_ID , Sale_Date, Daily_Sales,
          SUM(Daily_Sales) OVER (ORDER BY Product_ID,  Sale_Date
                          ROWS UNBOUNCED PRECEDING) as SUMOVER,
          SUM(1) OVER (ORDER BY Product_ID, Sale_Date
                          ROWS UNBOUNDED PRECEDING)    AS Seq_Number
FROM  Sales_Table ;
```

Product_ID	Sale_Date	Daily_Sales	SUM OVER	Seq_Number
1000	2000-09-28	48850.40	48850.40	1
1000	2000-09-29	54500.22	103350.62	2
1000	2000-09-30	36000.07	139350.69	3
1000	2000-10-01	40200.43	179551.12	4
1000	2000-10-02	32800.50	212351.62	5
1000	2000-10-03	64300.00	276651.62	6
1000	2000-10-04	54553.10	331204.72	7
2000	2000-09-28	41888.88	373093.60	8
2000	2000-09-29	48000.00	421093.60	9
2000	2000-09-30	49850.03	470943.63	10

Not all rows are displayed in this answer set

With “Seq_Number”, because you placed the number 1 in the area which calculates the cumulative sum, it’ll continuously add 1 to the answer for each row.

Troubleshooting The ANSI OLAP on a GROUP BY

```
SELECT Product_ID , Sale_Date, Daily_Sales,
              SUM(Daily_Sales) OVER (ORDER BY  Sale_Date
                    ROWS UNBOUNDED PRECEDING)    AS SUMOVER
FROM  Sales_Table
GROUP BY  Product_ID ;
```

Error! Why?

Never GROUP BY in a SUM()Over or with any ANSI Syntax OLAP command. If you want to reset you use a PARTITION BY Statement, but never a GROUP BY.

The ANSI OLAP – Reset with a PARTITION BY Statement

```sql
SELECT Product_ID , Sale_Date, Daily_Sales,
            SUM(Daily_Sales) OVER (PARTITION BY Product_ID
                     ORDER BY  Product_ID, Sale_Date
                    ROWS UNBOUNDED PRECEDING)    AS SumANSI
FROM  Sales_Table ;
```

```
Product_ID   Sale_Date    Daily_Sales      SumANSI
      1000   2000-09-28      48850.40     48850.40
      1000   2000-09-29      54500.22    103350.62
      1000   2000-09-30      36000.07    139350.69
      1000   2000-10-01      40200.43    179551.12
      1000   2000-10-02      32800.50    212351.62
      1000   2000-10-03      64300.00    276651.62
      1000   2000-10-04      54553.10    331204.72
      2000   2000-09-28      41888.88     41888.88
      2000   2000-09-29      48000.00     89888.88
      2000   2000-09-30      49850.03    139738.91
```

Not all rows are displayed in this answer set

The PARTITION Statement is how you reset in ANSI. This will cause the SUMANSI to start over (reset) on its calculating for each NEW Product_ID.

PARTITION BY only Resets a Single OLAP not ALL of them

```
SELECT Product_ID , Sale_Date, Daily_Sales,
   SUM(Daily_Sales) OVER (PARTITION BY Product_ID
   ORDER BY  Product_ID, Sale_Date
   ROWS UNBOUNDED PRECEDING)  AS Subtotal,
          SUM(Daily_Sales) OVER (ORDER BY Product_ID, Sale_Date
          ROWS UNBOUNDED PRECEDING)  AS GRANDTotal
FROM  Sales_Table ;
```

```
Product_ID   Sale_Date     Daily_Sales       SubTotal    GRANDTotal

      1000   2000-09-28      48850.40         48850.40      48850.40
      1000   2000-09-29      54500.22        103350.62     103350.62
      1000   2000-09-30      36000.07        139350.69     139350.69
      1000   2000-10-01      40200.43        179551.12     179551.12
      1000   2000-10-02      32800.50        212351.62     212351.62
      1000   2000-10-03      64300.00        276651.62     276651.62
      1000   2000-10-04      54553.10        331204.72     331204.72
      2000   2000-09-28      41888.88   ⬌     41888.88     373093.60
      2000   2000-09-29      48000.00         89888.88     421093.60
      2000   2000-09-30      49850.03        139738.91     470943.63
```

Not all rows are displayed in this answer set

Above are two OLAP statements. Only one has PARTITION BY so only it resets.

The Moving Average (MAVG) and Moving Window

```
SELECT  Product_ID , Sale_Date, Daily_Sales,
        MAVG( Daily_Sales, 3, Product_ID, Sale_Date) AS AVG3_Rows
                                                                FROM  Sales_Table
```

Moving Average

Moving Window

Major and Minor Sort keys

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	AVG3_Rows
1000	2000-09-28	48850.40	48850.40
1000	2000-09-29	54500.22	51675.31
1000	2000-09-30	36000.07	46450.23
1000	2000-10-01	40200.43	43566.91
1000	2000-10-02	32800.50	36333.67
1000	2000-10-03	64300.00	45788.98
1000	2000-10-04	54553.10	50551.20
2000	2000-09-28	41888.88	53580.66
2000	2000-09-29	48000.00	48147.33
2000	2000-09-30	49850.03	46579.11

This is the Moving Average (MAVG). It will calculate the average of 3 rows because that is the Moving Window. It will read the current row and TWO preceding to find the MAVG of those 3 rows. It will be sorted by Product_ID and Sale_Date first.

How the Moving Average is Calculated

```
SELECT  Product_ID , Sale_Date, Daily_Sales,
        MAVG( Daily_Sales, 3, Product_ID, Sale_Date) AS AVG3_Rows
FROM  Sales_Table
```

Product_ID	Sale_Date	Daily_Sales	AVG3_Rows
1000	2000-09-28	**48850.40**	48850.40
1000	2000-09-29	**54500.22**	51675.31
1000	2000-09-30	**36000.07**	**46450.23**
1000	2000-10-01	40200.43	43566.91
1000	2000-10-02	32800.50	36333.67
1000	2000-10-03	64300.00	45788.98
1000	2000-10-04	54553.10	50551.20
2000	2000-09-28	41888.88	53580.66
2000	2000-09-29	48000.00	48147.33
2000	2000-09-30	49850.03	46579.11
2000	2000-10-01	54850.29	50900.11
2000	2000-10-02	36021.93	46907.42

Not all rows are displayed in this answer set

With a Moving Window of 3, how is the 46450.23 amount derived in the AVG3_Rows column in the third row? It is the AVG of 48850.40, 54500.22 and 36000.07! The fourth row has AVG3_Rows equal to 43566.91. That was the average of 54500.22, 360000.07 and 40200.43. The calculation is on the current row and the two before.

How the Sort works for Moving Average (MAVG)

```
SELECT  Product_ID , Sale_Date, Daily_Sales,
        MAVG( Daily_Sales, 3, Product_ID, Sale_Date) AS AVG3_Rows
FROM  Sales_Table
```

Major and Minor
Sort keys

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	AVG3_Rows
1000	2000-09-28	48850.40	48850.40
1000	2000-09-29	54500.22	51675.31
1000	2000-09-30	36000.07	46450.23
1000	2000-10-01	40200.43	43566.91
1000	2000-10-02	32800.50	36333.67
1000	2000-10-03	64300.00	45788.98
1000	2000-10-04	54553.10	50551.20
2000	2000-09-28	41888.88	53580.66
2000	2000-09-29	48000.00	48147.33
2000	2000-09-30	49850.03	46579.11
2000	2000-10-01	54850.29	50900.11
2000	2000-10-02	36021.93	46907.42

The sorting is show above.

GROUP BY in the Moving Average does a Reset

```
SELECT       Product_ID , Sale_Date, Daily_Sales,
         MAVG( Daily_Sales, 3, Product_ID, Sale_Date) AS AVG3_Rows
FROM  Sales_Table
GROUP BY Product_ID;
```

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	AVG3_Rows
1000	2000-09-28	48850.40	48850.40
1000	2000-09-29	54500.22	51675.31
1000	2000-09-30	36000.07	46450.23
1000	2000-10-01	40200.43	43566.91
1000	2000-10-02	32800.50	36333.67
1000	2000-10-03	64300.00	45788.98
1000	2000-10-04	54553.10	50551.20
2000	2000-09-28	41888.88	41888.88
2000	2000-09-29	48000.00	44944.44
2000	2000-09-30	49850.03	46579.64

What does the GROUP BY Product_ID do? It causes a reset on all Product_ID breaks.

Quiz – Can you make the Advanced Calculation in your mind?

```
SELECT       Product_ID , Sale_Date, Daily_Sales,
      MAVG( Daily_Sales, 3, Product_ID, Sale_Date) AS AVG3_Rows
FROM  Sales_Table
GROUP BY Product_ID;
```

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	AVG3_Rows
1000	2000-09-28	48850.40	48850.40
1000	2000-09-29	54500.22	51675.31
1000	2000-09-30	36000.07	46450.23
1000	2000-10-01	40200.43	43566.91
1000	2000-10-02	32800.50	36333.67
1000	2000-10-03	64300.00	45788.98
1000	2000-10-04	54553.10	50551.20
2000	2000-09-28	41888.88	41888.88
2000	2000-09-29	48000.00	**44944.44**
2000	2000-09-30	49850.03	46579.64
2000	2000-10-01	54850.29	50900.11

How is the 44944.44 derived in the 9th row of the AVG_for_3_Rows?

Answer to Quiz for the Advanced Calculation in your mind?

```
SELECT        Product_ID , Sale_Date, Daily_Sales,
          MAVG( Daily_Sales, 3, Product_ID, Sale_Date) AS AVG3_Rows
FROM  Sales_Table
GROUP BY Product_ID;
```

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	AVG3_Rows
1000	2000-09-28	48850.40	48850.40
1000	2000-09-29	54500.22	51675.31
1000	2000-09-30	36000.07	46450.23
1000	2000-10-01	40200.43	43566.91
1000	2000-10-02	32800.50	36333.67
1000	2000-10-03	64300.00	45788.98
1000	2000-10-04	54553.10	50551.20
2000	2000-09-28	**41888.88**	41888.88
2000	2000-09-29	**48000.00**	**44944.44**
2000	2000-09-30	49850.03	46579.64

AVG of 41888.88 and 48000.00

Notice there are only two calculations although this has a moving window of 3. That is because the GROUP BY caused the MAVG to reset when Product_ID 2000 came.

Quiz – Write that Teradata Moving Average in ANSI Syntax

```
SELECT      Product_ID , Sale_Date, Daily_Sales,
        MAVG( Daily_Sales, 3, Product_ID, Sale_Date) AS AVG3_Rows
FROM  Sales_Table ;
```

Challenge

Can you place
another equivalent
Moving Average
in the SQL above
using ANSI Syntax?

Here is a challenge that almost everyone fails. Can you do it perfectly?

Both the Teradata Moving Average and ANSI Version

```
SELECT Product_ID , Sale_Date, Daily_Sales,
        MAVG( Daily_Sales, 3, Product_ID, Sale_Date) AS AVG_3,
                 AVG(Daily_Sales) OVER (ORDER BY Product_ID,
                      Sale_Date ROWS 2 Preceding)  AS AVG_3_ANSI
FROM  Sales_Table ;
```

Product_ID	Sale_Date	Daily_Sales	AVG_3	AVG_3_ANSI
1000	2000-09-28	48850.40	48850.40	48850.40
1000	2000-09-29	54500.22	51675.31	51675.31
1000	2000-09-30	36000.07	46450.23	46450.23
1000	2000-10-01	40200.43	43566.91	43566.91
1000	2000-10-02	32800.50	36333.67	36333.67
1000	2000-10-03	64300.00	45788.98	45788.98
1000	2000-10-04	54553.10	50551.20	50551.20
2000	2000-09-28	41888.88	53580.66	53580.66
2000	2000-09-29	48000.00	48147.33	48147.33
2000	2000-09-30	49850.03	46579.11	46579.11

Not all rows are displayed in this answer set

The MAVG and AVG(Over) commands above are equivalent. Notice the Moving Window of 3 in the Teradata syntax and that it is a 2 in the ANSI version. That is because in ANSI it is considered the Current Row and 2 preceding.

The ANSI Moving Window is Current Row and Preceding

```
SELECT Product_ID , Sale_Date, Daily_Sales,
          AVG(Daily_Sales) OVER (ORDER BY Product_ID, Sale_Date
                                      ROWS 2 Preceding)AS AVG_3_ANSI
FROM  Sales_Table ;
```

Moving Window of 3 rows

=

Calculate the Current Row and 2 rows preceding

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	AVG_3_ANSI
1000	2000-09-28	48850.40	48850.40
1000	2000-09-29	54500.22	51675.31
1000	2000-09-30	36000.07	46450.23
1000	2000-10-01	40200.43	43566.91
1000	2000-10-02	32800.50	36333.67
1000	2000-10-03	64300.00	45788.98
1000	2000-10-04	54553.10	50551.20
2000	2000-09-28	41888.88	53580.66
2000	2000-09-29	48000.00	48147.33
2000	2000-09-30	49850.03	46579.11

The AVG () Over allows you to do is to get the moving average of a certain column.

How ANSI Moving Average Handles the Sort

```
SELECT Product_ID , Sale_Date, Daily_Sales,
         AVG(Daily_Sales) OVER (ORDER BY Product_ID, Sale_Date
         ROWS 2 Preceding)AS AVG_3_ANSI
FROM  Sales_Table ;
```

Major and Minor Sort keys

```
Product_ID   Sale_Date    Daily_Sales   AVG_3_ANSI

     1000    2000-09-28    48850.40      48850.40
     1000    2000-09-29    54500.22      51675.31
     1000    2000-09-30    36000.07      46450.23
     1000    2000-10-01    40200.43      43566.91
     1000    2000-10-02    32800.50      36333.67
     1000    2000-10-03    64300.00      45788.98
     1000    2000-10-04    54553.10      50551.20
     2000    2000-09-28    41888.88      53580.66
     2000    2000-09-29    48000.00      48147.33
     2000    2000-09-30    49850.03      46579.11
     2000    2000-10-01    54850.29      50900.11
     2000    2000-10-02    36021.93      46907.42
```

Not all rows are displayed in this answer set

Much like the SUM OVER Command, the Average OVER places the sort after the ORDER BY.

Quiz – How is that Total Calculated?

```
SELECT Product_ID , Sale_Date, Daily_Sales,
        AVG(Daily_Sales) OVER (ORDER BY Product_ID, Sale_Date
                              ROWS 2 Preceding) AS AVG_3_ANSI
FROM  Sales_Table ;
```

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	AVG_3_ANSI
1000	2000-09-28	48850.40	48850.40
1000	2000-09-29	54500.22	51675.31
1000	2000-09-30	36000.07	**46450.23**
1000	2000-10-01	40200.43	43566.91
1000	2000-10-02	32800.50	36333.67
1000	2000-10-03	64300.00	45788.98
1000	2000-10-04	54553.10	50551.20
2000	2000-09-28	41888.88	53580.66
2000	2000-09-29	48000.00	48147.33
2000	2000-09-30	49850.03	46579.11
2000	2000-10-01	54850.29	50900.11
2000	2000-10-02	36021.93	46907.42

With a Moving Window of 3, how is the 46450.23 amount derived in the AVG_3_ANSI column in the third row?

Answer to Quiz – How is that Total Calculated?

```
SELECT Product_ID , Sale_Date, Daily_Sales,
          AVG(Daily_Sales) OVER (ORDER BY Product_ID, Sale_Date
                                   ROWS 2 Preceding) AS AVG_3_ANSI
FROM  Sales_Table ;
```

Product_ID	Sale_Date	Daily_Sales	AVG_3_ANSI
1000	2000-09-28	**48850.40**	48850.40
1000	2000-09-29	**54500.22**	51675.31
1000	2000-09-30	**36000.07**	**46450.23**
1000	2000-10-01	40200.43	43566.91
1000	2000-10-02	32800.50	36333.67
1000	2000-10-03	64300.00	45788.98
1000	2000-10-04	54553.10	50551.20
2000	2000-09-28	41888.88	53580.66
2000	2000-09-29	48000.00	48147.33
2000	2000-09-30	49850.03	46579.11
2000	2000-10-01	54850.29	50900.11
2000	2000-10-02	36021.93	46907.42

Not all rows are displayed in this answer set

AVG of 48850.40, 54500.22, and 36000.07

Quiz – How is that 4th Row Calculated?

```
SELECT Product_ID , Sale_Date, Daily_Sales,
        AVG(Daily_Sales) OVER (ORDER BY Product_ID, Sale_Date
                                  ROWS 2 Preceding) AS AVG_3_ANSI
FROM  Sales_Table ;
```

Product_ID	Sale_Date	Daily_Sales	AVG_3_ANSI
1000	2000-09-28	48850.40	48850.40
1000	2000-09-29	54500.22	51675.31
1000	2000-09-30	36000.07	46450.23
1000	2000-10-01	40200.43	**43566.91**
1000	2000-10-02	32800.50	36333.67
1000	2000-10-03	64300.00	45788.98
1000	2000-10-04	54553.10	50551.20
2000	2000-09-28	41888.88	53580.66
2000	2000-09-29	48000.00	48147.33
2000	2000-09-30	49850.03	46579.11
2000	2000-10-01	54850.29	50900.11
2000	2000-10-02	36021.93	46907.42

Not all rows are displayed in this answer set

With a Moving Window of 3, how is the 43566.91 amount derived in the AVG_3_ANSI column in the fourth row?

Answer to Quiz – How is that 4th Row Calculated?

```
SELECT Product_ID , Sale_Date, Daily_Sales,
          AVG(Daily_Sales) OVER (ORDER BY Product_ID, Sale_Date
                                        ROWS 2 Preceding) AS AVG_3_ANSI
FROM  Sales_Table;
```

Product_ID	Sale_Date	Daily_Sales	AVG_3_ANSI
1000	2000-09-28	48850.40	48850.40
1000	2000-09-29	**54500.22**	51675.31
1000	2000-09-30	**36000.07**	46450.23
1000	2000-10-01	**40200.43**	**43566.91**
1000	2000-10-02	32800.50	36333.67
1000	2000-10-03	64300.00	45788.98
1000	2000-10-04	54553.10	50551.20
2000	2000-09-28	41888.88	53580.66
2000	2000-09-29	48000.00	48147.33
2000	2000-09-30	49850.03	46579.11
2000	2000-10-01	54850.29	50900.11
2000	2000-10-02	36021.93	46907.42

Not all rows are displayed in this answer set

AVG of **54500.22, 36000.07,** and **40200.43**

Moving Average every 3-rows Vs a Continuous Average

```
SELECT Product_ID , Sale_Date, Daily_Sales,
 AVG(Daily_Sales) OVER (ORDER BY Product_ID, Sale_Date
                    ROWS   2 Preceding) AS AVG3,
 AVG(Daily_Sales) OVER (ORDER BY Product_ID, Sale_Date
                    ROWS UNBOUNDED Preceding) AS Continuous
FROM  Sales_Table;
```

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	AVG3	Continuous
1000	2000-09-28	48850.40	48850.40	48850.40
1000	2000-09-29	54500.22	51675.31	51675.31
1000	2000-09-30	36000.07	46450.23	46450.23
1000	2000-10-01	40200.43	43566.91	44887.78
1000	2000-10-02	32800.50	36333.67	42470.32
1000	2000-10-03	64300.00	45788.98	46108.60
1000	2000-10-04	54553.10	50551.20	47314.96
2000	2000-09-28	41888.88	53580.66	46636.70
2000	2000-09-29	48000.00	48147.33	46788.18

The ROWS 2 Preceding gives the MAVG for every 3 rows. The ROWS UNBOUNDED Preceding gives the continuous MAVG.

Partition By Resets an ANSI OLAP

```
SELECT  Product_ID , Sale_Date, Daily_Sales,
        AVG(Daily_Sales) OVER (ORDER BY Product_ID, Sale_Date
                                 ROWS 2 Preceding) AS AVG3,
        AVG(Daily_Sales) OVER (PARTITION BY Product_ID
        ORDER BY Product_ID, Sale_Date
        ROWS UNBOUNDED Preceding) AS Continuous
FROM  Sales_Table;
```

ANSI RESET much Like a GROUP BY

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	AVG3	Continuous
1000	2000-09-28	48850.40	48850.40	48850.40
1000	2000-09-29	54500.22	51675.31	51675.31
1000	2000-09-30	36000.07	46450.23	46450.23
1000	2000-10-01	40200.43	43566.91	44887.78
1000	2000-10-02	32800.50	36333.67	42470.32
1000	2000-10-03	64300.00	45788.98	46108.60
1000	2000-10-04	54553.10	50551.20	47314.96
2000	2000-09-28	**41888.88**	53580.66	**41888.88**
2000	2000-09-29	48000.00	48147.33	44944.44

Use a PARTITION BY Statement to Reset the ANSI OLAP.

The Moving Difference (MDIFF)

```
SELECT  Product_ID , Sale_Date, Daily_Sales,
      MDIFF(Daily_Sales, 4, Product_ID, Sale_Date) as “MDiff”
                  FROM Sales_Table ;
```

Moving Difference

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	MDiff
1000	2000-09-28	48850.40	?
1000	2000-09-29	54500.22	?
1000	2000-09-30	36000.07	?
1000	2000-10-01	40200.43	?
1000	2000-10-02	32800.50	-16049.90
1000	2000-10-03	64300.00	9799.78
1000	2000-10-04	54553.10	18553.03
2000	2000-09-28	41888.88	1688.45
2000	2000-09-29	48000.00	15199.50
2000	2000-09-30	49850.03	-14449.97
2000	2000-10-01	54850.29	297.19
2000	2000-10-02	36021.93	-5866.95
2000	2000-10-03	43200.18	-4799.82
2000	2000-10-04	32800.50	-17049.53

This is the Moving Difference (MDIFF). What this does is calculate the difference between the current row and only the 4th row preceding.

Moving Difference (MDIFF) Visual

```
SELECT  Product_ID , Sale_Date, Daily_Sales,
            MDIFF(Daily_Sales, 4, Product_ID, Sale_Date) as “MDiff”
FROM Sales_Table ;
```

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	MDiff
1000	2000-09-28	48850.40	?
1000	2000-09-29	**54500.22**	?
1000	2000-09-30	36000.07	?
1000	2000-10-01	40200.43	?
1000	2000-10-02	32800.50	-16049.90
1000	2000-10-03	**64300.00**	**9799.78**
1000	2000-10-04	54553.10	18553.03
2000	2000-09-28	41888.88	1688.45
2000	2000-09-29	48000.00	15199.50
2000	2000-09-30	49850.03	-14449.97
2000	2000-10-01	54850.29	297.19
2000	2000-10-02	36021.93	-5866.95
2000	2000-10-03	43200.18	-4799.82
2000	2000-10-04	32800.50	-17049.53

How much more did we make for Product_ID 1000 on 2000-10-03 versus Product_ID 1000 which was **4** rows earlier on 2000-09-29?

Moving Difference using ANSI Syntax

```
SELECT Product_ID, Sale_Date, Daily_Sales,
        Daily_Sales - SUM(Daily_Sales)
          OVER ( ORDER BY    Product_ID ASC, Sale_Date ASC
           ROWS BETWEEN 4  PRECEDING AND 4 PRECEDING)
                                                  AS "MDiff_ANSI"
FROM Sales_Table ;
```

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	MDiff_ANSI
1000	2000-09-28	48850.40	?
1000	2000-09-29	**54500.22**	?
1000	2000-09-30	36000.07	?
1000	2000-10-01	40200.43	?
1000	2000-10-02	32800.50	-16049.90
1000	2000-10-03	**64300.00**	**9799.78**
1000	2000-10-04	54553.10	18553.03
2000	2000-09-28	41888.88	1688.45
2000	2000-09-29	48000.00	15199.50
2000	2000-09-30	49850.03	-14449.97
2000	2000-10-01	54850.29	297.19
2000	2000-10-02	36021.93	-5866.95

This is how you do a MDiff using the ANSI Syntax with a moving window of 4.

Moving Difference using ANSI Syntax with Partition By

```
SELECT Product_ID, Sale_Date (Format 'yyyy-mm-dd'), Daily_Sales,
 Daily_Sales - SUM(Daily_Sales) OVER (PARTITION BY Product_ID
    ORDER BY Product_ID ASC, Sale_Date ASC
      ROWS BETWEEN 4 PRECEDING AND 4 PRECEDING)
                                                       AS "MDiff_ANSI"
FROM Sales_Table;
```

Product_ID	Sale_Date	Daily_Sales	MDiff_ANSI
1000	2000-09-28	48850.40	?
1000	2000-09-29	54500.22	?
1000	2000-09-30	36000.07	?
1000	2000-10-01	40200.43	?
1000	2000-10-02	32800.50	-16049.90
1000	2000-10-03	64300.00	9799.78
1000	2000-10-04	54553.10	18553.03
2000	2000-09-28	41888.88	?
2000	2000-09-29	48000.00	?
2000	2000-09-30	49850.03	?
2000	2000-10-01	54850.29	?
2000	2000-10-02	36021.93	-5866.95
2000	2000-10-03	43200.18	-4799.82
2000	2000-10-04	32800.50	-17049.53

Not all rows are displayed in this answer set

Wow! This is how you do a MDiff using the ANSI Syntax with a PARTITION BY.

Trouble Shooting the Moving Difference (MDIFF)

```
SELECT  Product_ID , Sale_Date, Daily_Sales,
  MDIFF(Daily_Sales, 7, Product_ID, Sale_Date) as Compare2Rows
FROM Sales_Table
GROUP BY Product_ID ;
```

Product_ID	Sale_Date	Daily_Sales	Compare2Rows
1000	2000-09-28	48850.40	?
1000	2000-09-29	54500.22	?
1000	2000-09-30	36000.07	?
1000	2000-10-01	40200.43	?
1000	2000-10-02	32800.50	?
1000	2000-10-03	64300.00	?
1000	2000-10-04	54553.10	?
2000	2000-09-28	41888.88	?
2000	2000-09-29	48000.00	?
2000	2000-09-30	49850.03	?
2000	2000-10-01	54850.29	?
2000	2000-10-02	36021.93	?
2000	2000-10-03	43200.18	?
2000	2000-10-04	32800.50	?

Not all rows
are displayed in
this answer set

Do you notice that column Compare2Rows did not produce any data? That is because the GROUP BY Reset before it could get 7 records to find the MDIFF.

The RANK Command

```
SELECT        Product_ID ,Sale_Date , Daily_Sales,
               RANK(Daily_Sales)  AS “Rank”
FROM   Sales_Table WHERE Product_ID IN (1000, 2000) ;
```

Product_ID	Sale_Date	Daily_Sales	Rank
1000	2000-10-03	64300.00	1
2000	2000-10-01	54850.29	2
1000	2000-10-04	54553.10	3
1000	2000-09-29	54500.22	4
2000	2000-09-30	49850.03	5
1000	2000-09-28	48850.40	6
2000	2000-09-29	48000.00	7
2000	2000-10-03	43200.18	8
2000	2000-09-28	41888.88	9
1000	2000-10-01	40200.43	10
2000	2000-10-02	36021.93	11
1000	2000-09-30	36000.07	12
2000	2000-10-04	32800.50	**13**
1000	2000-10-02	32800.50	**13**

This is the RANK. In this example, it will rank your Daily_Sales from greatest to least. The default for this type of RANK is to sort DESC.

How to get Rank to Sort in Ascending Order

```
SELECT        Product_ID ,Sale_Date , Daily_Sales,
              RANK(Daily_Sales ASC)  AS "Rank"
FROM   Sales_Table  WHERE Product_ID IN (1000, 2000) ;
```

Product_ID	Sale_Date	Daily_Sales	Rank
1000	2000-10-02	32800.50	1
2000	2000-10-04	32800.50	1
1000	2000-09-30	36000.07	3
2000	2000-10-02	36021.93	4
1000	2000-10-01	40200.43	5
2000	2000-09-28	41888.88	6
2000	2000-10-03	43200.18	7
2000	2000-09-29	48000.00	8
1000	2000-09-28	48859.40	9
2000	2000-09-30	49850.03	10
1000	2000-09-29	54500.22	11
1000	2000-10-04	54553.10	12
2000	2000-10-01	54850.29	13
1000	2000-10-03	64300.00	14

This RANK query sorts in Ascending mode.

Two ways to get Rank to Sort in Ascending Order

```
SELECT        Product_ID ,Sale_Date , Daily_Sales,
              RANK(Daily_Sales ASC)  AS Rank1,
              RANK(-Daily_Sales)         AS Rank2
FROM   Sales_Table  WHERE Product_ID IN (1000, 2000) ;
```

Product_ID	Sale_Date	Daily_Sales	Rank1	Rank2
1000	2000-10-02	32800.50	1	1
2000	2000-10-04	32800.50	1	1
1000	2000-09-30	36000.07	3	3
2000	2000-10-02	36021.93	4	4
1000	2000-10-01	40200.43	5	5
2000	2000-09-28	41888.88	6	6
2000	2000-10-03	43200.18	7	7
2000	2000-09-29	48000.00	8	8
1000	2000-09-28	48859.40	9	9
2000	2000-09-30	49850.03	10	10
1000	2000-09-29	54500.22	11	11
1000	2000-10-04	54553.10	12	12
2000	2000-10-01	54850.29	13	13
1000	2000-10-03	64300.00	14	14

A minus sign or keyword ASC will sort Both RANK in Ascending mode.

RANK using ANSI Syntax Defaults to Ascending Order

```
SELECT        Product_ID ,Sale_Date , Daily_Sales,
          RANK()  OVER (ORDER BY Daily_Sales) AS Rank1
FROM   Sales_Table
WHERE Product_ID IN (1000, 2000)
```

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	Rank1
2000	2000-10-04	32800.50	**1**
1000	2000-10-04	32800.50	**1**
1000	2000-09-30	65000.07	3
2000	2000-10-02	36021.93	4
1000	2000-10-01	40200.43	5
2000	2000-09-28	41888.88	6
2000	2000-10-03	43200.18	7
2000	2000-09-29	48000.00	8

This is the RANK() OVER. It provides a rank for your queries. Notice how you do not place anything within the () after the word RANK. Default Sort is ASC.

Getting RANK using ANSI Syntax to Sort in DESC Order

```
SELECT  Product_ID ,Sale_Date , Daily_Sales,
            RANK()  OVER (ORDER BY Daily_Sales DESC) AS Rank1
FROM   Sales_Table
WHERE Product_ID IN (1000, 2000) ;
```

Not all rows are displayed in this answer set

```
Product_ID   Sale_Date     Daily_Sales    Rank1

      2000   2000-09-29      48000.00         1
      2000   2000-10-03      43200.00         2
      2000   2000-09-28      41888.88         3
      1000   2000-10-01      40200.43         4
      2000   2000-10-02      36032.93         5
      1000   2000-09-30      65000.07         6
      1000   2000-10-04      32800.50         8
      2000   2000-10-04      32800.50         8
```

Is the query above in ASC mode or DESC mode for sorting?

RANK() OVER and PARTITION BY with a QUALIFY

```
SELECT  Product_ID ,Sale_Date , Daily_Sales,
             RANK()  OVER (PARTITION BY Product_ID
                                   ORDER BY Daily_Sales DESC) AS Rank1
FROM   Sales_Table
WHERE Product_ID IN (1000, 2000)
QUALIFY Rank1 < 4
```

```
Product_ID   Sale_Date     Daily_Sales     Rank1

      1000    2000-10-03     65000.07          1
      1000    2000-10-04     54553.10          2
      1000    2000-09-29     54500.22          3
      2000    2000-10-01     54850.29          1
      2000    2000-09-30     49850.03          2
      2000    2000-09-29     48000.00          3
```

What does the PARTITION Statement in the RANK() OVER do? It resets the rank.
The QUALIFY statement limits rows once the Rank’s been calculated.

QUALIFY and WHERE

```
SELECT       Product_ID ,Sale_Date , Daily_Sales,
             RANK(Daily_Sales ASC)  AS Rank1,
             RANK(-Daily_Sales)     AS Rank2
FROM   Sales_Table
WHERE Product_ID IN (1000, 2000)
QUALIFY Rank(-Daily_Sales) < 6 ;
```

Product_ID	Sale_Date	Daily_Sales	Rank1	Rank2
1000	2000-10-02	32800.50	1	1
2000	2000-10-04	32800.50	1	1
1000	2000-09-30	36000.07	3	3
2000	2000-10-02	36021.93	4	4
1000	2000-10-01	40200.43	5	5

The WHERE statement is performed first. It limits the rows being calculated. Then the QUALIFY takes the calculated rows and limits the returning rows. QUALIFY is to OLAP what HAVING is to Aggregates. Both limit after the calculations.

Quiz – How can you simplify the QUALIFY Statement

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
            RANK(Daily_Sales ASC)  AS Rank1,
            RANK(-Daily_Sales)         AS Rank2
FROM   Sales_Table
WHERE Product_ID IN (1000, 2000)
QUALIFY Rank(-Daily_Sales) < 6 ;
```

```
Product_ID   Sale_Date      Daily_Sales     Rank1    Rank2

      1000    2000-10-02     32800.50          1        1
      2000    2000-10-04     32800.50          1        1
      1000    2000-09-30     36000.07          3        3
      2000    2000-10-02     36021.93          4        4
      1000    2000-10-01     40200.43          5        5
```

How can you improve the QUALIFY Statement above for simplicity?

Answer to Quiz –Can you simplify the QUALIFY Statement

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
          RANK(Daily_Sales ASC)  AS Rank1,
          RANK(-Daily_Sales)       AS Rank2
FROM   Sales_Table
WHERE Product_ID IN (1000, 2000)
QUALIFY Rank2 < 6 ;
```

```
Product_ID   Sale_Date    Daily_Sales    Rank1   Rank2

     1000    2000-10-02     32800.50         1       1
     2000    2000-10-04     32800.50         1       1
     1000    2000-09-30     36000.07         3       3
     2000    2000-10-02     36021.93         4       4
     1000    2000-10-01     40200.43         5       5
```

QUALIFY Rank2 < 6
(Use the Alias)

The QUALIFY Statement without Ties

```
SELECT       Product_ID ,Sale_Date , Daily_Sales,
             RANK(Daily_Sales)  AS Rank1
FROM   Sales_Table
WHERE Product_ID IN (1000, 2000)
QUALIFY Rank1 < 6 ;
```

```
Product_ID    Sale_Date      Daily_Sales     Rank1

      1000     2000-10-03      64300.00          1
      2000     2000-10-01      54850.29          2
      1000     2000-10-04      54553.10          3
      1000     2000-09-29      54500.22          4
      2000     2000-09-30      49850.03          5
```

A QUALIFY < 6 will provide a result that is 5 rows. Notice there are NO ties, yet!

The QUALIFY Statement with Ties

```
SELECT      Product_ID ,Sale_Date , Daily_Sales,
            RANK(Daily_Sales ASC)  AS Rank1
FROM   Sales_Table
WHERE Product_ID IN (1000, 2000)
QUALIFY Rank1 < 6 ;
```

```
Product_ID   Sale_Date    Daily_Sales    Rank1
      1000   2000-10-02      32800.50        1
      2000   2000-10-04      32800.50        1
      1000   2000-09-30      36000.07        3
      2000   2000-10-02      36021.93        4
      1000   2000-10-01      40200.43        5
```

A QUALIFY < 6 will provide a result that is 5 rows. Notice there are Ties!

The QUALIFY Statement with Ties Brings back Extra Rows

```
SELECT       Product_ID ,Sale_Date , Daily_Sales,
             RANK(Daily_Sales ASC)  AS Rank1
FROM   Sales_Table
WHERE Product_ID IN (1000, 2000)
QUALIFY Rank1 < 2 ;
```

Product_ID	Sale_Date	Daily_Sales	Rank1
1000	2000-10-02	32800.50	1
2000	2000-10-04	32800.50	1

A QUALIFY < 2 will provide more rows than 1 because of the Ties!

Mixing Sort Order for QUALIFY Statement

```
SELECT       Product_ID ,Sale_Date , Daily_Sales,
         RANK(Daily_Sales)  AS Rank1
FROM   Sales_Table
WHERE Product_ID IN (1000, 2000)
QUALIFY RANK (Daily_Sales ASC) < 6 ;
```

DESC Mode

ASC Mode

Product_ID	Sale_Date	Daily_Sales	Rank1
1000	2000-10-02	32800.50	**13**
2000	2000-10-04	32800.50	**13**
1000	2000-09-30	36000.07	**12**
2000	2000-10-02	36021.93	**11**
1000	2000-10-01	40200.43	**10**

Look at the Rankings and the Daily_Sales. This data come out odd because Rank1 is DESC by default (using this Syntax) and the QUALIFY specifies ASC mode.

Quiz – What Caused the RANK to Reset?

```
SELECT        Product_ID ,Sale_Date , Daily_Sales,
              RANK(Daily_Sales)  AS Rank1
FROM   Sales_Table
WHERE Product_ID IN (1000, 2000)
GROUP BY  Product_ID
QUALIFY Rank1 < 4 ;
```

Product_ID	Sale_Date	Daily_Sales	Rank1
1000	2000-10-03	64300.00	1
1000	2000-10-04	54553.10	2
1000	2000-09-29	54500.22	3
2000	2000-10-01	54850.29	1
2000	2000-09-30	49850.03	2
2000	2000-09-29	48000.00	3

What caused the data to reset the column Rank1?

Answer to Quiz – What Caused the RANK to Reset?

```
SELECT        Product_ID ,Sale_Date , Daily_Sales,
              RANK(Daily_Sales)  AS Rank1
FROM   Sales_Table
WHERE Product_ID IN (1000, 2000)
GROUP BY  Product_ID
QUALIFY Rank1 < 4 ;
```

Product_ID	Sale_Date	Daily_Sales	Rank1
1000	2000-10-03	64300.00	1
1000	2000-10-04	54553.10	2
1000	2000-09-29	54500.22	3
2000	2000-10-01	54850.29	1
2000	2000-09-30	49850.03	2
2000	2000-09-29	48000.00	3

GROUP BY

Quiz – Name those Sort Orders

```
RANK()  OVER (ORDER BY Daily_Sales) AS ANSI_Rank
```

Is the default above ASC or DESC?

```
RANK(Daily_Sales)  AS NON_ANSI_Rank
```

Is the default above ASC or DESC?

Answer the questions above.

Answer to Quiz – Name those Sort Orders

RANK() OVER (ORDER BY Daily_Sales) AS ANSI_Rank

Defaults to ASC

RANK(Daily_Sales) AS NON_ANSI_Rank

Defaults to DESC

Please note that by default these different syntaxes sort completely opposite.

PERCENT_RANK() OVER

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
           PERCENT_RANK() OVER (PARTITION BY PRODUCT_ID
            ORDER BY Daily_Sales DESC) AS PercentRank1
FROM   Sales_Table WHERE Product_ID in (1000, 2000) ;
```

Product_ID	Sale_Date	Daily_Sales	PercentRank1
1000	2000-10-03	64300.00	0.000000
1000	2000-10-04	54553.10	0.166667
1000	2000-09-29	54500.22	0.333333
1000	2000-09-28	48850.40	0.500000
1000	2000-10-01	40200.43	0.666667
1000	2000-09-30	36000.07	0.833333
1000	**2000-10-02**	**32800.50**	**1.000000**
2000	**2000-10-01**	**54850.29**	**0.000000**
2000	2000-09-30	49850.03	0.166667
2000	2000-09-29	48000.00	0.333333
2000	2000-10-03	43200.18	0.500000
2000	2000-09-28	41888.88	0.666667
2000	2000-10-02	36021.93	0.833333
2000	2000-10-04	32800.50	1.000000

7 Rows in Calculation for 1000 Product_ID

7 Rows in Calculation for 2000 Product_ID

We now have added a Partition statement which produces 7 rows per Product_ID.

PERCENT_RANK() OVER with 14 rows in Calculation

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
          PERCENT_RANK() OVER ( ORDER BY Daily_Sales DESC)
                                                   AS PercentRank1
FROM   Sales_Table  WHERE Product_ID IN (1000, 2000) ;
```

Product_ID	Sale_Date	Daily_Sales	PercentRank1
1000	2000-10-03	64300.00	0.000000
2000	2000-10-01	54850.29	0.076923
1000	2000-10-04	54553.10	0.153846
1000	2000-09-29	54500.22	0.230769
2000	2000-09-30	49850.03	0.307692
1000	2000-09-28	48850.40	0.384615
2000	2000-09-29	48000.00	0.461538
2000	2000-10-03	43200.18	0.538462
2000	2000-09-28	41888.88	0.615385
1000	2000-10-01	40200.43	0.692308
2000	2000-10-02	36021.93	0.769231
1000	2000-09-30	36000.07	0.846154
2000	2000-10-04	32800.50	0.923077
1000	2000-10-02	32800.50	0.923077

14 Rows in Calculation for both the 1000 and 2000 Product_IDs

Percentage_Rank is just like RANK however, it gives you the Rank as a percent, but only a percent of all the other rows up to 100%.

PERCENT_RANK() OVER with 21 rows in Calculation

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
          PERCENT_RANK() OVER ( ORDER BY Daily_Sales DESC)
                                                  AS PercentRank1
FROM   Sales_Table ;
```

Product_ID	Sale_Date	Daily_Sales	PercentRank1
1000	2000-10-03	64300.00	0.000000
3000	2000-09-28	61301.77	0.050000
2000	2000-10-01	54850.29	0.100000
1000	2000-10-04	54553.10	0.150000
1000	2000-09-29	54500.22	0.200000
2000	2000-09-30	49850.03	0.250000
1000	2000-09-28	48850.40	0.300000
2000	2000-09-29	48000.00	0.350000
3000	2000-09-30	43868.86	0.400000
2000	2000-10-03	43200.18	0.450000
2000	2000-09-28	41888.88	0.500000
1000	2000-10-01	40200.43	0.550000
2000	2000-10-02	36021.93	0.600000
1000	2000-09-30	36000.07	0.650000

Not all rows are displayed in this answer set

21 Rows in Calculation for all of the Product_IDs

Percentage_Rank is just like RANK however, it gives you the Rank as a percent, but only a percent of all the other rows up to 100%.

Quiz – What Cause the Product_ID to Reset

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
        PERCENT_RANK() OVER (PARTITION BY PRODUCT_ID
        ORDER BY Daily_Sales DESC) AS PercentRank1
FROM   Sales_Table WHERE Product_ID in (1000, 2000) ;
```

Product_ID	Sale_Date	Daily_Sales	PercentRank1
1000	2000-10-03	64300.00	0.000000
1000	2000-10-04	54553.10	0.166667
1000	2000-09-29	54500.22	0.333333
1000	2000-09-28	48850.40	0.500000
1000	2000-10-01	40200.43	0.666667
1000	2000-09-30	36000.07	0.833333
1000	**2000-10-02**	**32800.50**	**1.000000**
2000	**2000-10-01**	**54850.29**	**0.000000**
2000	2000-09-30	49850.03	0.166667
2000	2000-09-29	48000.00	0.333333
2000	2000-10-03	43200.18	0.500000
2000	2000-09-28	41888.88	0.666667
2000	2000-10-02	36021.93	0.833333
2000	2000-10-04	32800.50	1.000000

What caused the Product_IDs to be sorted?

Answer to Quiz – What Cause the Product_ID to Reset

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
          PERCENT_RANK() OVER (PARTITION BY PRODUCT_ID
          ORDER BY Daily_Sales DESC) AS PercentRank1
FROM   Sales_Table WHERE Product_ID in (1000, 2000) ;
```

Product_ID	Sale_Date	Daily_Sales	PercentRank1
1000	2000-10-03	64300.00	0.000000
1000	2000-10-04	54553.10	0.166667
1000	2000-09-29	54500.22	0.333333
1000	2000-09-28	48850.40	0.500000
1000	2000-10-01	40200.43	0.666667
1000	2000-09-30	36000.07	0.833333
1000	**2000-10-02**	**32800.50**	**1.000000**
2000	**2000-10-01**	**54850.29**	**0.000000**
2000	2000-09-30	49850.03	0.166667
2000	2000-09-29	48000.00	0.333333
2000	2000-10-03	43200.18	0.500000
2000	2000-09-28	41888.88	0.666667
2000	2000-10-02	36021.93	0.833333
2000	2000-10-04	32800.50	1.000000

PARTITION BY caused the data to be sorted!

COUNT OVER for a Sequential Number

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
              COUNT(*)  OVER (ORDER BY Product_ID, Sale_Date
              ROWS UNBOUNDED PRECEDING) AS Seq_Number
FROM   Sales_Table  WHERE Product_ID IN (1000, 2000) ;
```

Product_ID	Sale_Date	Daily_Sales	Seq_Number
1000	2000-09-28	48850.40	**1**
1000	2000-09-29	54500.22	**2**
1000	2000-09-30	36000.07	**3**
1000	2000-10-01	40200.43	**4**
1000	2000-10-02	32800.50	**5**
1000	2000-10-03	64300.00	**6**
1000	2000-10-04	54553.10	**7**
2000	2000-09-28	41888.88	**8**
2000	2000-09-29	48000.00	**9**
2000	2000-09-30	49850.03	**10**
2000	2000-10-01	54850.29	**11**

Not all rows are displayed in this answer set

This is the COUNT OVER. It will provide a sequential number starting at 1. The Keyword(s) ROWS UNBOUNDED PRECEDING causes Seq_Number to start at the beginning and increase sequentially to the end.

Troubleshooting COUNT OVER

```
SELECT        Product_ID ,Sale_Date , Daily_Sales,
COUNT(*)  OVER (ORDER BY Product_ID, Sale_Date) AS No_Seq
FROM   Sales_Table  WHERE Product_ID IN (1000, 2000) ;
```

Rows Unbounded Preceding is missing in this statement.

Product_ID	Sale_Date	Daily_Sales	Seq_Number
1000	2000-09-28	48850.40	14
1000	2000-09-29	54500.22	14
1000	2000-09-30	36000.07	14
1000	2000-10-01	40200.43	14
1000	2000-10-02	32800.50	14
1000	2000-10-03	64300.00	14
1000	2000-10-04	54553.10	14
2000	2000-09-28	41888.88	14
2000	2000-09-29	48000.00	14
2000	2000-09-30	49850.03	14
2000	2000-10-01	54850.29	14
2000	2000-10-02	36021.93	14
2000	2000-10-03	43200.18	14
2000	2000-10-04	32800.50	14

14 rows came back

When you don’t have a ROWS UNBOUNDED PRECEDING, No_Seq get a value of 14 on every row. Why? Because 14 is the FINAL COUNT NUMBER.

Quiz – What caused the COUNT OVER to Reset?

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
           COUNT(*)  OVER (PARTITION BY Product_ID
                                        ORDER BY Product_ID, Sale_Date
                           ROWS UNBOUNDED PRECEDING) AS StartOver
FROM   Sales_Table  WHERE Product_ID IN (1000, 2000) ;
```

Product_ID	Sale_Date	Daily_Sales	StartOver
1000	2000-09-28	48850.40	1
1000	2000-09-29	54500.22	2
1000	2000-09-30	36000.07	3
1000	2000-10-01	40200.43	4
1000	2000-10-02	32800.50	5
1000	2000-10-03	64300.00	6
1000	2000-10-04	54553.10	7
2000	2000-09-28	41888.88	1
2000	2000-09-29	48000.00	2
2000	2000-09-30	49850.03	3
2000	2000-10-01	54850.29	4
2000	2000-10-02	36021.93	5
2000	2000-10-03	43200.18	6
2000	2000-10-04	32800.50	7

What Keyword(s) caused StartOver to reset?

Answer to Quiz – What caused the COUNT OVER to Reset?

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
          COUNT(*)  OVER (PARTITION BY Product_ID
                                    ORDER BY Product_ID, Sale_Date
                      ROWS UNBOUNDED PRECEDING) AS StartOver
FROM   Sales_Table  WHERE Product_ID IN (1000, 2000) ;
```

```
Product_ID   Sale_Date    Daily_Sales    StartOver

      1000   2000-09-28     48850.40            1
      1000   2000-09-29     54500.22            2
      1000   2000-09-30     36000.07            3
      1000   2000-10-01     40200.43            4
      1000   2000-10-02     32800.50            5
      1000   2000-10-03     64300.00            6
      1000   2000-10-04     54553.10            7
      2000   2000-09-28     41888.88            1
      2000   2000-09-29     48000.00            2
      2000   2000-09-30     49850.03            3
      2000   2000-10-01     54850.29            4
      2000   2000-10-02     36021.93            5
      2000   2000-10-03     43200.18            6
      2000   2000-10-04     32800.50            7
```

PARTITION BY

The MAX OVER Command

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
         MAX(Daily_Sales)  OVER (ORDER BY Product_ID, Sale_Date
            ROWS UNBOUNDED PRECEDING) AS MaxOver
FROM   Sales_Table  WHERE Product_ID IN (1000, 2000) ;
```

Product_ID	Sale_Date	Daily_Sales	MaxOver
1000	2000-09-28	48850.40	48850.40
1000	2000-09-29	**54500.22**	54500.22
1000	2000-09-30	36000.07	54500.22
1000	2000-10-01	40200.43	54500.22
1000	2000-10-02	32800.50	54500.22
1000	2000-10-03	**64300.00**	64300.00
1000	2000-10-04	54553.10	64300.00
2000	2000-09-28	41888.88	64300.00
2000	2000-09-29	48000.00	64300.00
2000	2000-09-30	49850.03	64300.00
2000	2000-10-01	54850.29	64300.00
2000	2000-10-02	36021.93	64300.00
2000	2000-10-03	43200.18	64300.00
2000	2000-10-04	32800.50	64300.00

After the sort the Max() Over shows the Max Value up to that point.

MAX OVER with PARTITION BY Reset

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
                MAX(Daily_Sales)  OVER (PARTITION BY Product_ID
                     ORDER BY Product_ID, Sale_Date
                          ROWS UNBOUNDED PRECEDING) AS MaxOver
FROM   Sales_Table  WHERE Product_ID IN (1000, 2000) ;
```

Product_ID	Sale_Date	Daily_Sales	MaxOver
1000	2000-09-28	48850.40	48850.40
1000	2000-09-29	54500.22	54500.22
1000	2000-09-30	36000.07	54500.22
1000	2000-10-01	40200.43	54500.22
1000	2000-10-02	32800.50	54500.22
1000	2000-10-03	64300.00	64300.00
1000	2000-10-04	54553.10	64300.00
2000	2000-09-28	41888.88	41888.88
2000	2000-09-29	48000.00	48000.00
2000	2000-09-30	49850.03	49850.03
2000	2000-10-01	54850.29	54850.29

Not all rows are displayed in this answer set

The largest value is 64300.00 in the column MaxOver. Once it was evaluated it did not continue until the end because of the PARTITION BY reset.

Troubleshooting MAX OVER

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
        MAX(Daily_Sales)  OVER (ORDER BY Product_ID, Sale_Date )
                                                          AS MaxOver
FROM   Sales_Table  WHERE Product_ID IN (1000, 2000) ;
```

Rows Unbounded Preceding is missing in this statement.

Not all rows are displayed in this answer set

Product_ID	Sale_Date	Daily_Sales	MaxOver
1000	2000-09-28	48850.40	64300.00
1000	2000-09-29	54500.22	64300.00
1000	2000-09-30	36000.07	64300.00
1000	2000-10-01	40200.43	64300.00
1000	2000-10-02	32800.50	64300.00
1000	2000-10-03	64300.00	64300.00
1000	2000-10-04	54553.10	64300.00
2000	2000-09-28	41888.88	64300.00
2000	2000-09-29	48000.00	64300.00
2000	2000-09-30	49850.03	64300.00

You can also use MAX as a OLAP. 64300.00 came back in MaxOver because that was the MAX value for Daily_Sales in this Answer Set. Notice that it doesn’t have a ROWS UNBOUNDED PRECEDING.

The MIN OVER Command

```
SELECT Product_ID, Sale_Date ,Daily_Sales
          ,Min(Daily_Sales)  OVER (ORDER BY Product_ID, Sale_Date
                        ROWS UNBOUNDED PRECEDING) AS MinOver
FROM   Sales_Table  WHERE Product_ID IN (1000, 2000) ;
```

Product_ID	Sale_Date	Daily_Sales	MinOver
1000	2000-09-28	**48850.40**	48850.40
1000	2000-09-29	54500.22	48850.40
1000	2000-09-30	**36000.07**	36000.07
1000	2000-10-01	40200.43	36000.07
1000	2000-10-02	**32800.50**	32800.50
1000	2000-10-03	64300.00	32800.50
1000	2000-10-04	54553.10	32800.50
2000	2000-09-28	41888.88	32800.50
2000	2000-09-29	48000.00	32800.50
2000	2000-09-30	49850.03	32800.50
2000	2000-10-01	54850.29	32800.50
2000	2000-10-02	36021.93	32800.50
2000	2000-10-03	43200.18	32800.50
2000	2000-10-04	32800.50	32800.50

After the sort the MIN () Over shows the Max Value up to that point.

Troubleshooting MIN OVER

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
          MIN(Daily_Sales)  OVER (ORDER BY Product_ID, Sale_Date )
                                                              AS MinOver
FROM   Sales_Table  WHERE Product_ID IN (1000, 2000) ;
```

Rows Unbounded Preceding is missing in this statement.

Not all rows are displayed in this answer set

```
Product_ID   Sale_Date    Daily_Sales    MinOver

      1000   2000-09-28      48850.40   32800.50
      1000   2000-09-29      54500.22   32800.50
      1000   2000-09-30      36000.07   32800.50
      1000   2000-10-01      40200.43   32800.50
      1000   2000-10-02      32800.50   32800.50
      1000   2000-10-03      64300.00   32800.50
      1000   2000-10-04      54553.10   32800.50
      2000   2000-09-28      41888.88   32800.50
      2000   2000-09-29      48000.00   32800.50
      2000   2000-09-30      49850.03   32800.50
      2000   2000-10-01      54850.29   32800.50
```

Min only displayed 32800.50 because there is NOT a ROWS UNBOUNDED PRECEDING statement so it found the lowest Daily_Sales and repeated it.

Quiz – Fill in the Blank

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
            Min(Daily_Sales)  OVER (PARTITION BY Product_ID
                  ORDER BY Product_ID, Sale_Date
                       ROWS UNBOUNDED PRECEDING) AS MinOver
FROM   Sales_Table  WHERE Product_ID IN (1000, 2000) ;
```

Product_ID	Sale_Date	Daily_Sales	MinOver
1000	2000-09-28	48850.40	48850.40
1000	2000-09-29	54500.22	48850.40
1000	2000-09-30	36000.07	36000.07
1000	2000-10-01	40200.43	36000.07
1000	2000-10-02	32800.50	32800.50
1000	2000-10-03	64300.00	32800.50
1000	2000-10-04	54553.10	32800.50
2000	2000-09-28	41888.88	41888.88
2000	2000-09-29	48000.00	41888.88
2000	2000-09-30	49850.03	41888.88
2000	2000-10-01	54850.29	41888.88
2000	2000-10-02	36021.93	36021.93
2000	2000-10-03	43200.18	
2000	2000-10-04	32800.50	

The last two answers (MinOver) are blank so you can fill in the blank.

Answer to Quiz – Fill in the Blank

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
            Min(Daily_Sales)  OVER (PARTITION BY Product_ID
                  ORDER BY Product_ID, Sale_Date
                       ROWS UNBOUNDED PRECEDING) AS MinOver
FROM   Sales_Table  WHERE Product_ID IN (1000, 2000) ;
```

Product_ID	Sale_Date	Daily_Sales	MinOver
1000	2000-09-28	48850.40	48850.40
1000	2000-09-29	54500.22	48850.40
1000	2000-09-30	36000.07	36000.07
1000	2000-10-01	40200.43	36000.07
1000	2000-10-02	32800.50	32800.50
1000	2000-10-03	64300.00	32800.50
1000	2000-10-04	54553.10	32800.50
2000	2000-09-28	41888.88	41888.88
2000	2000-09-29	48000.00	41888.88
2000	2000-09-30	49850.03	41888.88
2000	2000-10-01	54850.29	41888.88
2000	2000-10-02	**36021.93**	**36021.93**
2000	2000-10-03	43200.18	**36021.93**
2000	2000-10-04	32800.50	**32800.50**

The Row_Number Command

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
        ROW_NUMBER() OVER (ORDER BY Product_ID, Sale_Date)
             AS Seq_Number
FROM   Sales_Table  WHERE Product_ID IN (1000, 2000) ;
```

Product_ID	Sale_Date	Daily_Sales	Seq_Number
1000	2000-09-28	48850.40	1
1000	2000-09-29	54500.22	2
1000	2000-09-30	36000.07	3
1000	2000-10-01	40200.43	4
1000	2000-10-02	32800.50	5
1000	2000-10-03	64300.00	6
1000	2000-10-04	54553.10	7
2000	2000-09-28	41888.88	8
2000	2000-09-29	48000.00	9
2000	2000-09-30	49850.03	10
2000	2000-10-01	54850.29	11

Not all rows are displayed in this answer set

The ROW_NUMBER() Keyword(s) caused Seq_Number to increase sequentially.
Notice that this does NOT have a Rows Unbounded Preceding and it still works!

Quiz – How did the Row_Number Reset?

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
            ROW_NUMBER() OVER (PARTITION BY Product_ID
                ORDER BY Product_ID, Sale_Date )   AS StartOver
FROM   Sales_Table  WHERE Product_ID IN (1000, 2000) ;
```

Product_ID	Sale_Date	Daily_Sales	StartOver
1000	2000-09-28	48850.40	1
1000	2000-09-29	54500.22	2
1000	2000-09-30	36000.07	3
1000	2000-10-01	40200.43	4
1000	2000-10-02	32800.50	5
1000	2000-10-03	64300.00	6
1000	2000-10-04	54553.10	7
2000	2000-09-28	41888.88	1
2000	2000-09-29	48000.00	2
2000	2000-09-30	49850.03	3
2000	2000-10-01	54850.29	4
2000	2000-10-02	36021.93	5
2000	2000-10-03	43200.18	6
2000	2000-10-04	32800.50	7

What Keyword(s) caused StartOver to reset?

Quiz – How did the Row_Number Reset?

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
            ROW_NUMBER() OVER (PARTITION BY Product_ID
                ORDER BY Product_ID, Sale_Date )   AS StartOver
FROM   Sales_Table  WHERE Product_ID IN (1000, 2000) ;
```

```
Product_ID   Sale_Date     Daily_Sales        StartOver

      1000   2000-09-28     48850.40                  1
      1000   2000-09-29     54500.22                  2
      1000   2000-09-30     36000.07                  3
      1000   2000-10-01     40200.43                  4
      1000   2000-10-02     32800.50                  5
      1000   2000-10-03     64300.00                  6
      1000   2000-10-04     54553.10                  7
      2000   2000-09-28     41888.88                  1
      2000   2000-09-29     48000.00                  2
      2000   2000-09-30     49850.03                  3
      2000   2000-10-01     54850.29                  4
      2000   2000-10-02     36021.93                  5
      2000   2000-10-03     43200.18                  6
      2000   2000-10-04     32800.50                  7
```

What Keyword(s) caused StartOver to reset?

PARTITION BY

Testing Your Knowledge

```
SELECT Product_ID , Sale_Date, Daily_Sales,
              CSUM(Daily_Sales, Product_ID, Sale_Date)    AS “CSum”
FROM  Sales_Table WHERE Product_ID BETWEEN 1000 and 2000
GROUP BY Product_ID ;
```

This is the CSUM. However, what we want to see is the Sum()Over ANSI version. Use the information in the CSUM and convert this to the equivalent Sum()Over.

Testing Your Knowledge

```
SELECT Product_ID , Sale_Date, Daily_Sales,
                CSUM(Daily_Sales, Product_ID, Sale_Date)    AS “CSum”
FROM  Sales_Table WHERE Product_ID BETWEEN 1000 and 2000
GROUP BY Product_ID ;
```

```
SELECT Product_ID , Sale_Date, Daily_Sales,
               SUM(Daily_Sales) OVER (PARTITION BY Product_ID
                 ORDER BY  Product_ID, Sale_Date
                   ROWS UNBOUNDED PRECEDING)    AS SumANSI
FROM  Sales_Table
WHERE Product_ID BETWEEN 1000 and 2000 ;
```

Both statements are exactly the same except the bottom example uses ANSI syntax.

Testing Your Knowledge

```
SELECT Product_ID , Sale_Date, Daily_Sales,
   MAVG( Daily_Sales, 3, Product_ID, Sale_Date) AS AVG_for_3_Rows
FROM  Sales_Table WHERE Product_ID BETWEEN 1000 and 2000 ;
```

Write the equivalent to the SQL above using ANSI Syntax such as AVG () Over.

Testing Your Knowledge

```
SELECT Product_ID , Sale_Date, Daily_Sales,
MAVG( Daily_Sales, 3, Product_ID, Sale_Date) AS AVG_for_3_Rows
FROM  Sales_Table WHERE Product_ID BETWEEN 1000 and 2000 ;
```

```
SELECT Product_ID , Sale_Date, Daily_Sales,
   AVG(Daily_Sales) OVER (ORDER BY Product_ID, Sale_Date
                              ROWS 2 Preceding) AS AVG_3_ANSI
FROM  Sales_Table WHERE Product_ID BETWEEN 1000 and 2000  ;
```

The SQL above is equivalent except the bottom example uses ANSI Syntax.

Testing Your Knowledge

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
            RANK(Daily_Sales)  AS “Rank”
FROM   Sales_Table
WHERE Product_ID IN (1000, 2000) ;
```

This is the Rank. However, what we want to see is the RANK()Over. Use the information in the Rank to make it the Rank()Over.

Testing Your Knowledge

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
            RANK(Daily_Sales)  AS “Rank”
FROM   Sales_Table
WHERE Product_ID IN (1000, 2000) ;
```

```
SELECT Product_ID ,Sale_Date , Daily_Sales,
            RANK()  OVER (ORDER BY Daily_Sales DESC) AS Rank1
FROM   Sales_Table
WHERE Product_ID IN (1000, 2000)
```

The SQL above is equivalent except the bottom example uses ANSI Syntax. Also notice the sort key. DESC is the default in the top example.