Multi Level Data Navigation with MicroStrategy

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Introduction

- What is multi-level data (MLD)?
- Why is MLD important?
- How is MLD best implemented?
- How do you create a schema to navigate it?
- Fully worked example
- A parting word
- Summary

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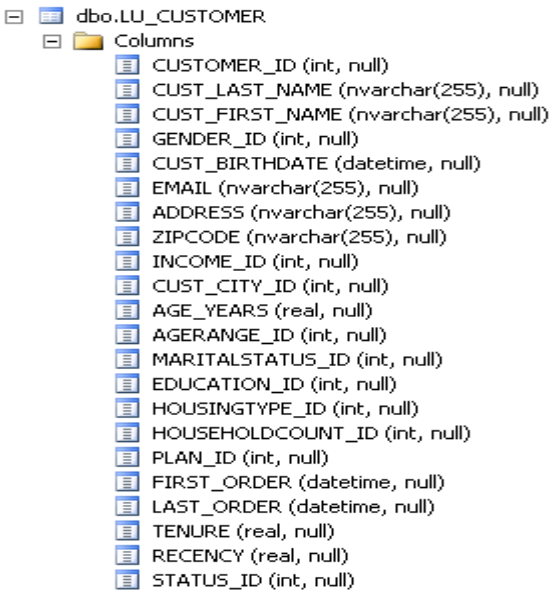
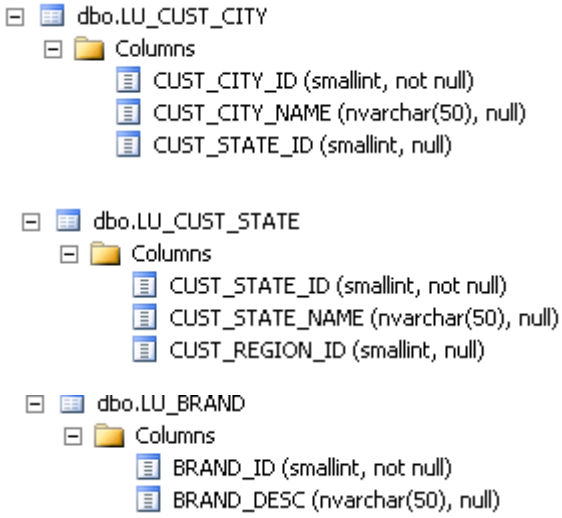
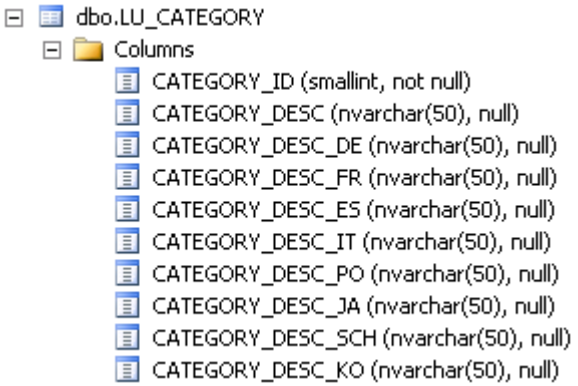
What is Multi-Level Data?

- The vast majority of queries use summary data
- Microstrategy has implemented Intelligent Cubes to support this behaviour
- Microstrategy has implemented multi-level lookup tables for many years







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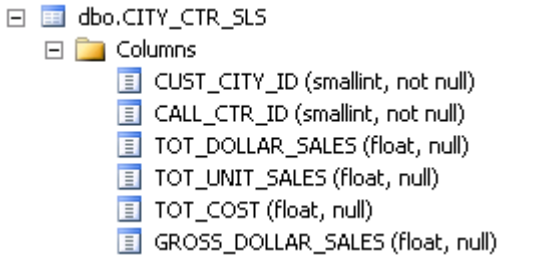
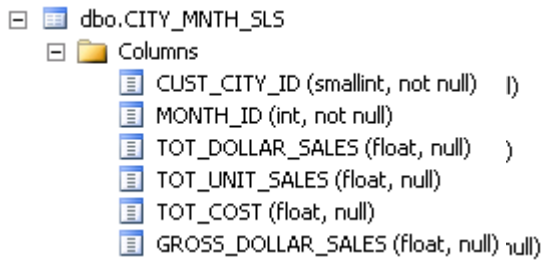
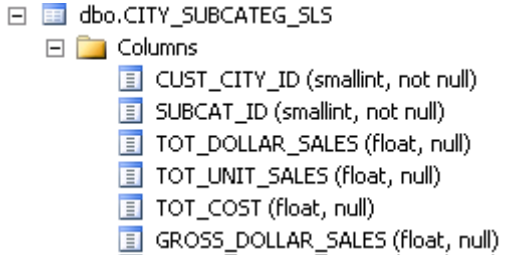
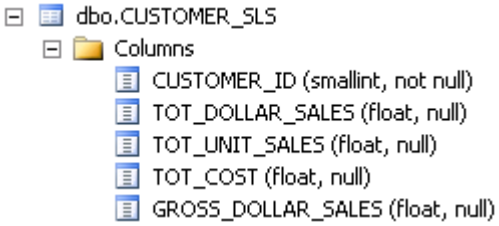
What is Multi-Level Data?

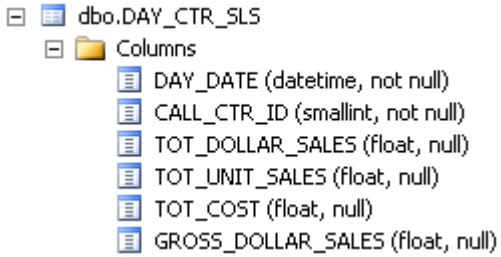
- You can see them in the tutorial database…
- These are example summary level fact tables

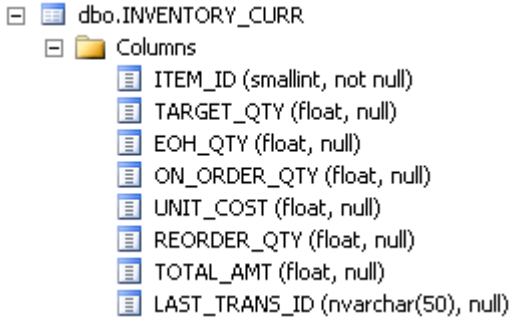












- The following diagrams show you simple diagrams of how these things evolved

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Evolution of BI Models

- Pre 1995 no companies mixed 3NF and Dimensional
  - Companies did one or the other…not both
- In late 1995 two pioneers ‘tried out’ mixing the two modeling techniques in one design. It worked well.
- Since 1996 these two pioneers recommended to clients the most complete solution was a combination of both
  - It is also the most expensive approach
  - Not everyone would buy into this approach
- Diagram on next page shows ‘Best Practice Since 1996’…

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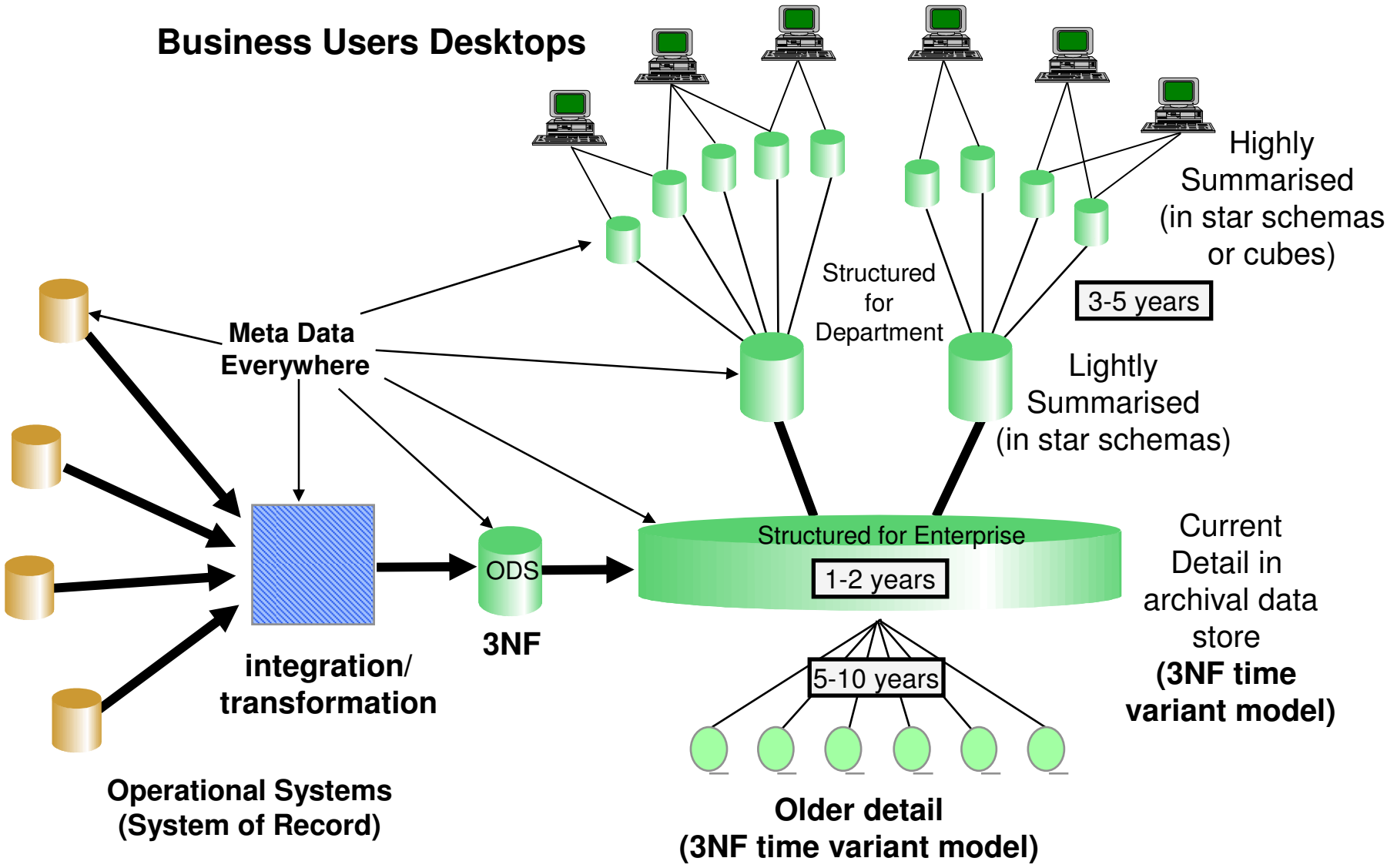
Best Practice Since 1996



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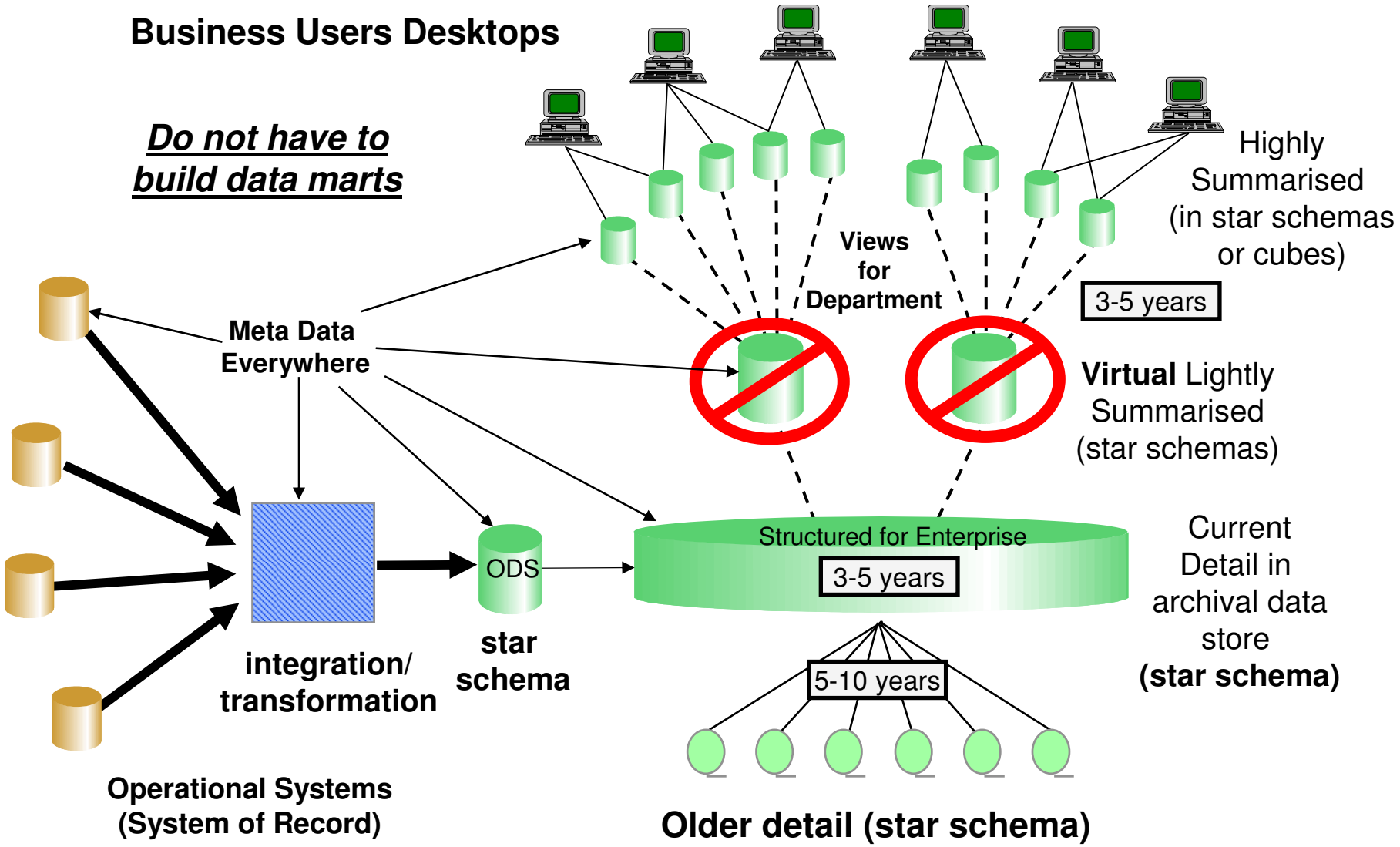
New BIDA Proposition



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Why Is MLD Important?

- #1 reason is speed of query
- If you summarise 1000x the query will be 1000x faster…approximately
- Summarisation is the #1 tool for fast queries
- Everyone does it no matter some deny it
- Particularly necessary for dashboards and interactive query processing such as drill down
- MSTR has done this for many years

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How Is MLD Best Implemented?

- Ralph Kimball of “Star Schema” fame did it best
- These skills were “lost” in the 90s
- It is done by using a single underlying table with a “Level” column and views places over the top
- Having one table per summary costs a lot of maintenance time for ETL programmers
- 100% replicates Microstrategy recommendations
- So lets look at an example
- Our friend the day table…

The Multi Level Day Table

```
CREATE TABLE [dbo].[TD0005](
[pk_TD0005] [int] NOT NULL DEFAULT ((0)),
[level_col] [varchar](10) NOT NULL DEFAULT ('unknown'),
[dim_char_ky_fld] [varchar](255) NOT NULL DEFAULT ('unknown'),
[day_date] [datetime] NULL,
[day_name] [varchar](9) NULL,
[day_name_sdesc] [varchar](3) NULL,
[day_in_week] [int] NULL,
[day_in_month] [int] NULL,
[day_in_year] [int] NULL,
[week_in_month] [int] NULL,
[week_in_year] [int] NULL,
[month_name] [varchar](15) NULL,
[month_name_sdesc] [varchar](3) NULL,
[month_in_year] [int] NULL,
[calendar_qtr] [int] NULL,
[calendar_qtr_str] [varchar](1) NULL,
[month_in_qtr] [int] NULL,
[week_in_qtr] [int] NULL,
[day_in_qtr] [int] NULL,
[financial_qtr] [int] NULL,
[financial_qtr_str] [varchar](1) NULL,
[financial_year] [int] NULL,
[financial_year_name] [varchar](255) NULL,
[month_in_fncl_qtr] [int] NULL,
[week_in_fncl_qtr] [int] NULL,
[day_in_fncl_qtr] [int] NULL,
[year_name] [varchar](4) NULL,
[year_num] [int] NULL,
[season_name] [varchar](15) NULL,
[season_name_sdesc] [varchar](3) NULL,
[num_days_since_1970] [int] NULL,
[num_weeks_since_1970] [int] NULL,
[num_months_since_1970] [int] NULL,
[hldy_ind] [varchar](1) NULL,
[xmas_hldy_ind] [varchar](1) NULL,
[easter_hldy_ind] [varchar](1) NULL,
[last_day_in_month_flag] [varchar](1) NULL,
[same_weekday_year_ago] [datetime] NULL,
[week_begin_date] [datetime] NULL,
[report_period_01_flag] [varchar](1) NOT NULL DEFAULT ('N'),
[report_period_02_flag] [varchar](1) NOT NULL DEFAULT ('N'),
[report_period_03_flag] [varchar](1) NOT NULL DEFAULT ('N'),
[report_period_04_flag] [varchar](1) NOT NULL DEFAULT ('N'),
[report_period_05_flag] [varchar](1) NOT NULL DEFAULT ('N'),
[week_day_ind] [char](1) NULL DEFAULT ('N'),
[year_month_num] [int] NULL DEFAULT ((0))
```

```
[td0005_key_ag1] [int] NOT NULL CONSTRAINT [DF_TD0005_td0005_ag1]  DEFAULT ((0)),
[td0005_key_ag2] [int] NOT NULL CONSTRAINT [DF_TD0005_td0005_ag2]  DEFAULT ((0)),
[td0005_key_ag3] [int] NOT NULL CONSTRAINT [DF_TD0005_td0005_ag3]  DEFAULT ((0)),
[td0005_key_ag4] [int] NOT NULL CONSTRAINT [DF_TD0005_td0005_ag4]  DEFAULT ((0)),
[td0005_key_ag5] [int] NOT NULL CONSTRAINT [DF_TD0005_td0005_ag5]  DEFAULT ((0)),
[td0005_key_ag6] [int] NOT NULL CONSTRAINT [DF_TD0005_td0005_ag6]  DEFAULT ((0)),
[td0005_key_ag7] [int] NOT NULL CONSTRAINT [DF_TD0005_td0005_ag7]  DEFAULT ((0)),
[td0005_key_ag8] [int] NOT NULL CONSTRAINT [DF_TD0005_td0005_ag8]  DEFAULT ((0)),
[td0005_key_ag9] [int] NOT NULL CONSTRAINT [DF_TD0005_td0005_ag9]  DEFAULT ((0)),
```

- Note the primary key
- Level column set to “detail” and level1-9
- Dim_char_ky_fld set to character string key
- Various fields describing the date
- These fields can be created in Excel and loaded
- Notice 9 aggregate keys

The Multi Level Day Table

```
SELECT TOP 1000 [pk_TD0005]
      ,[level_col]
      ,[dim_char_ky_fld]
      ,[day_date]
      ,[td0005_key_ag1]
      ,[td0005_key_ag2]
      ,[td0005_key_ag3]
      ,[td0005_key_ag8]
      ,[td0005_key_ag9]
  FROM [EBIHS_C006_DWH].[dbo].[TD0005]
  order by 1
```

- Note the primary key is unique and sequential
- Level column set to “detail” and level1-8 + “Total”
- Levels are Day, Week, Months, Quarter, Year, Total
- Dim_char_ky_fld set to character string key
- Day date included to show the date
- Other fields removed from slide
- Notice aggregate keys for all higher levels on rows
- Detail rows have all levels keys above them set

PK	level_col	char_ky_fld	day_date	ag1	ag2	ag3	ag8	g9
2	total	directive_total	1990-01-01 00:00:00.000	0	0	0	0	0
3	level8	1990	1990-01-01 00:00:00.000	0	0	0	0	2
4	level3	19901	1990-01-01 00:00:00.000	0	0	0	3	2
5	level2	19901	1990-01-01 00:00:00.000	0	0	4	3	2
6	level1	19901	1990-01-01 00:00:00.000	0	5	4	3	2
7	detail	1990-01-01	1990-01-01 00:00:00.000	6	5	4	3	2
8	detail	1990-01-02	1990-01-02 00:00:00.000	6	5	4	3	2
9	detail	1990-01-03	1990-01-03 00:00:00.000	6	5	4	3	2
10	detail	1990-01-04	1990-01-04 00:00:00.000	6	5	4	3	2
11	detail	1990-01-05	1990-01-05 00:00:00.000	6	5	4	3	2
12	detail	1990-01-06	1990-01-06 00:00:00.000	6	5	4	3	2
13	detail	1990-01-07	1990-01-07 00:00:00.000	6	5	4	3	2
14	level1	19902	1990-01-08 00:00:00.000	0	5	4	3	2
15	detail	1990-01-08	1990-01-08 00:00:00.000	14	5	4	3	2

The Day View

```
create view [dbo].[vm_day] as select
TD0005.pk_TD0005            pk_vm_day
,TD0005.day_date            day_date
,TD0005.day_name            day_name
...
,TD0005.level_col           level_col
,TD0005.dim_char_ky_fld     dim_char_ky_fld
,TD0005.td0005_key_ag1      dk_vm_week
,TD0005.td0005_key_ag2      dk_vm_month
,TD0005.td0005_key_ag3      dk_vm_quarter
,TD0005.td0005_key_ag8      dk_vm_year
,TD0005.td0005_key_ag9      dk_vm_time_total
from dbo.TD0005
where ( TD0005.level_col  = 'detail' ) or  TD0005.pk_TD0005 = 0
```

- MSTR sees vm_day as identical to a “table”
- Notice the “id” columns for higher level keys are visible on the view so MSTR can use them in hierarchies
- On the next slides we will show week, month, quarter, year views

PK	day_date	level_col	char_ky	week	month	quarter	year	total
7	1990-01-01 00:00:00.000	detail	1990-01-01	6	5	4	3	2
8	1990-01-02 00:00:00.000	detail	1990-01-02	6	5	4	3	2
9	1990-01-03 00:00:00.000	detail	1990-01-03	6	5	4	3	2
10	1990-01-04 00:00:00.000	detail	1990-01-04	6	5	4	3	2
11	1990-01-05 00:00:00.000	detail	1990-01-05	6	5	4	3	2
12	1990-01-06 00:00:00.000	detail	1990-01-06	6	5	4	3	2
13	1990-01-07 00:00:00.000	detail	1990-01-07	6	5	4	3	2
15	1990-01-08 00:00:00.000	detail	1990-01-08	14	5	4	3	2
16	1990-01-09 00:00:00.000	detail	1990-01-09	14	5	4	3	2

The Multi Level Day Table

Week

PK	week_begin_date	dk_vm_month	dk_vm_quarter	dk_vm_year	dk_vm_time_total
6	1990-01-01 00:00:00.000	5	4	3	2
14	1990-01-08 00:00:00.000	5	4	3	2
22	1990-01-15 00:00:00.000	5	4	3	2
30	1990-01-22 00:00:00.000	5	4	3	2
38	1990-01-29 00:00:00.000	5	4	3	2
47	1990-02-05 00:00:00.000	42	4	3	2
55	1990-02-12 00:00:00.000	42	4	3	2
63	1990-02-19 00:00:00.000	42	4	3	2
71	1990-02-26 00:00:00.000	42	4	3	2

Month

PK	first_day_of_month	month_name	dk_vm_quarter	dk_vm_year	dk_vm_time_total
5	1990-01-01 00:00:00.000	January	4	3	2
42	1990-02-01 00:00:00.000	February	4	3	2
75	1990-03-01 00:00:00.000	March	4	3	2
112	1990-04-01 00:00:00.000	April	111	3	2
148	1990-05-01 00:00:00.000	May	111	3	2
184	1990-06-01 00:00:00.000	June	111	3	2

Quarter

PK	first_day_of_quarter	dk_vm_year	dk_vm_time_total
4	1990-01-01 00:00:00.000	3	2
111	1990-04-01 00:00:00.000	3	2
219	1990-07-01 00:00:00.000	3	2
328	1990-10-01 00:00:00.000	3	2
439	1991-01-01 00:00:00.000	438	2

Year

PK	first_day_of_year	year_name	dk_vm_time_total
3	1990-01-01 00:00:00.000	1990	2
438	1991-01-01 00:00:00.000	1991	2
873	1992-01-01 00:00:00.000	1992	2

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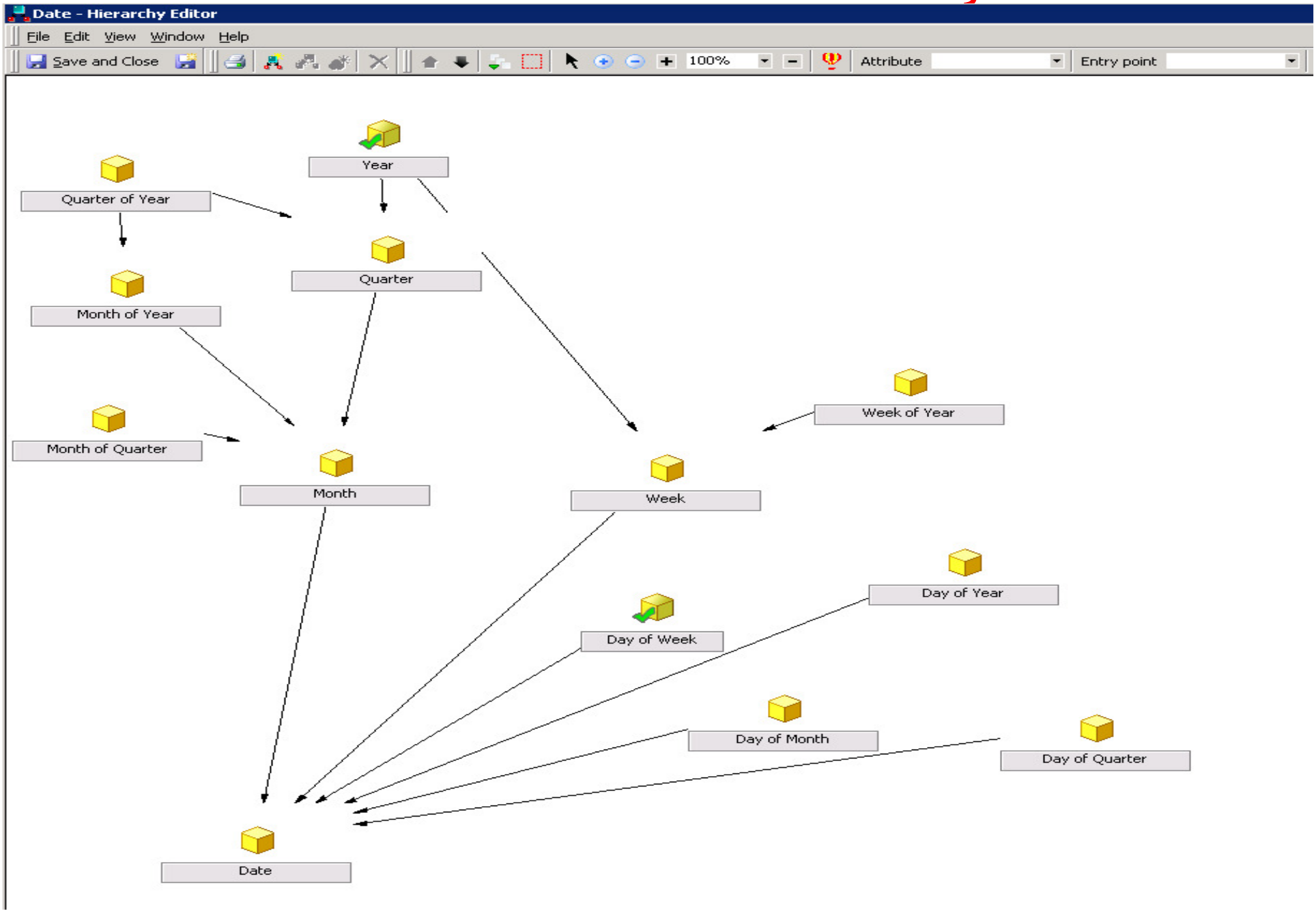
MSTR Date Hierarchy



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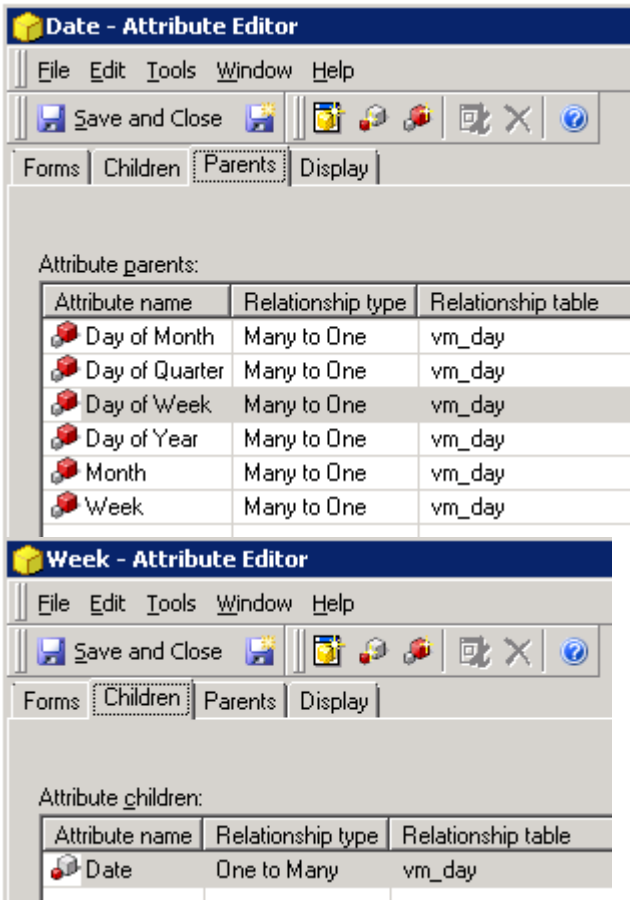
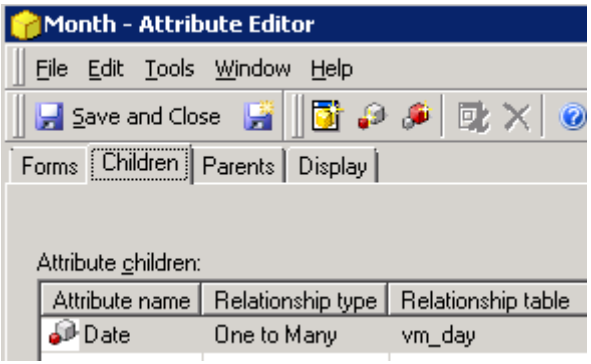
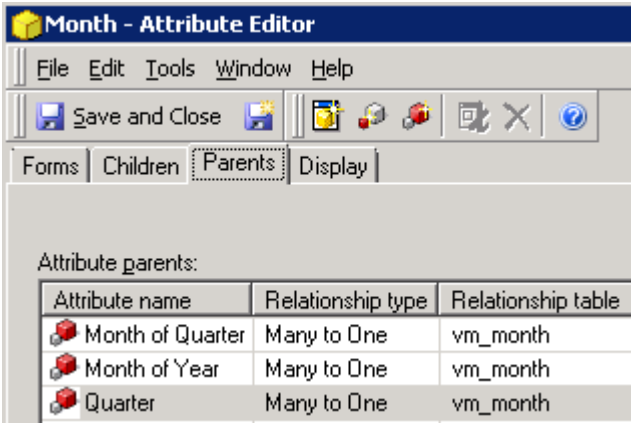
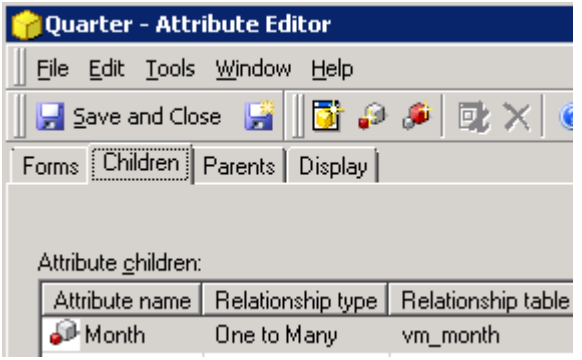
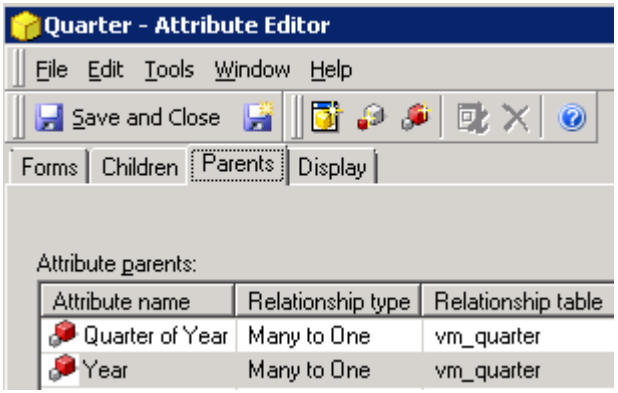
The MSTR Date Hierarchy

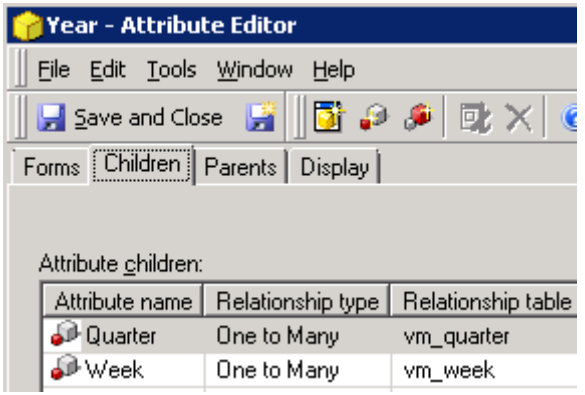












- Notice the hierarchies set up just as normal
- They are all using views, not tables

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The Multi Level Invoice Line Table

- So now we are ready to create multi-level facts
- These are accounts payable invoice lines, just for example
- We have day, week, month, quarter and year
  - vf_ap_invoice_line
  - vf_ap_invoice_line_week
  - vf_ap_invoice_line_month
  - vf_ap_invoice_line_quarter
  - vf_ap_invoice_line_year
- The day level is “detail” and has its own table
- The higher levels all cohabit the same table with a summary number in the view…see over

The Multi Level Invoice Line Table

- View snippets are as follows…

```
create view [dbo].[vf_ap_invoice_line] as select
TF0101.pk_TF0101  pk_vf_ap_invoice_line
.....
from dbo.TF0101
where TF0101.table_number = 508
```

```
create view [dbo].[vf_ap_invoice_line_week] as select
...

from z01_vf_ap_invoice_line_01_summary
where pk_aggregate_number = 201
```

```
create view [dbo].[vf_ap_invoice_line_month]
as select
...

from z01_vf_ap_invoice_line_01_summary
where pk_aggregate_number = 202
```

```
create view [dbo].[vf_ap_invoice_line_quarter]
as select
...

from z01_vf_ap_invoice_line_01_summary
where pk_aggregate_number = 203
```

```
create view [dbo].[vf_ap_invoice_line_year]
as select
...

from z01_vf_ap_invoice_line_01_summary
where  pk_aggregate_number = 204
```

- So now we will show you a short video that captures the SQL from MSTR and shows you that the summary levels are accessed properly
- We will also include the SQL on the following slides
- We just want to prove MSTR navigates the summaries perfectly!

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Video Demonstration

The Multi Level Invoice Line Table

- SQL snippets are as follows…

Day

```
select      a11.dk_vm_invoice_date  pk_vm_day,
            max(CONVERT(DATETIME,
            CONVERT(VARCHAR(10), a12.day_date, 101)))  day_date,
            sum(a11.amount_col)  WJXBFS1
from        vf_ap_invoice_line          a11
            join        vm_day          a12
            on          (a11.dk_vm_invoice_date = a12.pk_vm_day)
group by    a11.dk_vm_invoice_date
```

Week

```
select      a11.dk_vm_invoice_week  pk_vm_week,
            max(a12.week_in_year)  week_in_year,
            sum(a11.amount_col)  WJXBFS1
from        vf_ap_invoice_line_week     a11
            join        vm_week         a12
            on          (a11.dk_vm_invoice_week =
                        a12.pk_vm_week)
group by    a11.dk_vm_invoice_week
```

Month

```
select      a11.dk_vm_invoice_month  pk_vm_month,
            max(a12.month_name_sdesc)  month_name_sdesc,
            sum(a11.amount_col)  WJXBFS1
from        vf_ap_invoice_line_month    a11
            join        vm_month        a12
            on          (a11.dk_vm_invoice_month =
                        a12.pk_vm_month)
group by    a11.dk_vm_invoice_month
```

Quarter

```
select      a11.dk_vm_invoice_quarter  pk_vm_quarter,
            max(a12.calendar_qtr)  calendar_qtr,
            sum(a11.amount_col)  WJXBFS1
from        vf_ap_invoice_line_quarter  a11
            join        vm_quarter      a12
            on          (a11.dk_vm_invoice_quarter =
                        a12.pk_vm_quarter)
group by    a11.dk_vm_invoice_quarter
```

Year

```
select      a11.dk_vm_invoice_year  pk_vm_year,
            max(a12.year_num)  year_num,
            sum(a11.amount_col)  WJXBFS1
from        vf_ap_invoice_line_year     a11
            join        vm_year         a12
              on        (a11.dk_vm_invoice_year = a12.pk_vm_year)
group by    a11.dk_vm_invoice_year
```

- Notice how the from and join clauses change to get data from the correct level of the day table and correct level of the ap invoice line fact tables.
- MSTR navigates summaries perfectly
- EBI Builds summaries perfectly

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A Parting Word

- Multi Level Summaries are the #1 tool to create fast queries inside the database
- Using separate tables requires separate ETL
- With our Big Data Accelerator product we can create multi-level summaries simply and easily
- We use special multi-level aware ETL to populate the multi-level summaries with no extra work
- We look forward to helping you create your summaries faster, more easily and, most importantly, less expensively

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Summary

- What is multi-level data (MLD)?
- Why is MLD important?
- How is MLD best implemented?
- How do you create a schema to navigate it?
- Fully worked example
- A parting word
- Summary

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Thank You for Your Time!