

Case Study of Improving BI Apps and OBIEE Performance

Session ID: 10847

Prepared by:

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@VlamisSoftware



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#C16LV





Manufacturer of fiber optic and transmission products to Telco, Broadband, and Electric Utility industries.



Oracle Gold Partner and expert consultants in Oracle Business Intelligence, analytics, and data warehousing.



Producers of APE Diagnostics, a tool for BI performance diagnostics.

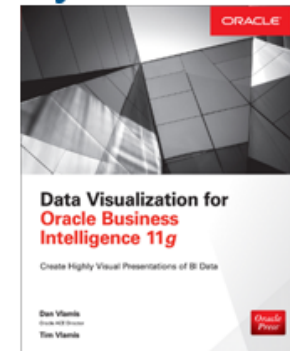
Vlamis Software Solutions



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- Vlamis Software founded in 1992 in Kansas City, Missouri
- Developed more than 200 Oracle BI and Analytics systems
- Specializes in ORACLE-based:
 - Business Intelligence & Analytics
 - Data Mining and Predictive Analytics
 - Data Visualization
 - Data Warehousing
- Expert presenter at major Oracle conferences
- www.vlamis.com (blog, papers, newsletters, services)
- Co-authors of book “Data Visualization for OBI 11g”
- Co-author of book “Oracle Essbase & Oracle OLAP”
- Oracle University Partner
- Oracle Gold Partner



ORACLE EDUCATION RESELLER

ORACLE Gold Partner

Specialized
Oracle Business Intelligence
Foundation Suite 11g



Mike Caskey



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- Mike (IT Architect and hands-on expert)
- 20+ years in data warehousing, software engineer and OLAP
- 10+ years of this time in Healthcare BI as co-founder and lead architect of a software company, developing 6 product solutions
- Expert in multiple Enterprise Data Warehouse design and implementations across industries



Jeff McBride



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- 20 plus years experience in the areas of Information Technology, Project Management, Finance, and Business Operations.
- Currently the Manager of Business Intelligence at AFL
 - Joined AFL in 2012
 - Focused on Delivering End Users with Highly Interactive visual content to meet their reporting and analysis needs
- Holds an MBA from Emory University and BS in Computer Science from The Citadel.



AFL Background

- Global provider of innovative and scalable fiber optic solutions, engineering expertise and integrated services to service provider, utility and enterprise markets
- Financially sound: \$1 billion in revenue
- 4,000+ associates worldwide
- Products in use in 120+ countries
- Operations in US, Canada, Mexico, Europe, Australia
- AFL is a wholly owned subsidiary of Fujikura headquartered in Tokyo, Japan



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AFL Business Intelligence Environment



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- Tools
 - Oracle Enterprise Business Suite
 - OBIEE 11.1.1.9.5x
 - BI Apps 7.9.6.4
 - Sales Order Management and Inventory
 - Financials
 - Procurement and Spend
- Utilization
 - 120+ Users (Up from 10 in 2012)
 - 25k Queries per month (Up from 5k per month in 2012)
 - 36 Custom Built Dashboards
 - 30 AFL Customized Subject areas
- Support Team
 - 3 RPD and Informatica Developers
 - 3 Business Analyst/Dashboard developers



Background

- Hardware – DB & Application Server
 - 2 Quad cores – 16 cores @3.3GHz
 - 96 Gig of Ram
- Software
 - Database – Oracle 11.2.0.4.0
 - Troype APE Diagnostics

Configuration	SMALL	MEDIUM	LARGE
Target Tier			
Target Volume	Up to 200 Gb	200 Gb to 1 Tb	1 Tb and higher
# CPU cores	16	32	64*
Physical RAM	32-64 Gb	64-128 Gb	256+ Gb*
Storage Space	Up to 400 Gb	400 Gb – 2 Tb	2T b and higher
Storage System	Local (PATA, SATA, iSCSI), or NAS, preferred RAID configuration	High performance SCSI or SAN with 16 Gbps HBA or higher, connected over fiber channel / 2xGb Ethernet NIC	High performance SCSI or SAN with 24 Gbps HBA or higher, connected over fiber channel / 2xGb Ethernet NIC
Oracle BI Enterprise Edition / ETL Tier			
# CPU cores	8	16	32
Physical RAM	8 Gb	16 Gb	32 Gb
Storage Space	100 Gb local	200 Gb local	400 Gb local



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Problem Statement



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Problem

- User experience suffering because of degrading performance
- Several analyses running in excess of one minute
- ETL processes struggling to fit into a tight overnight window

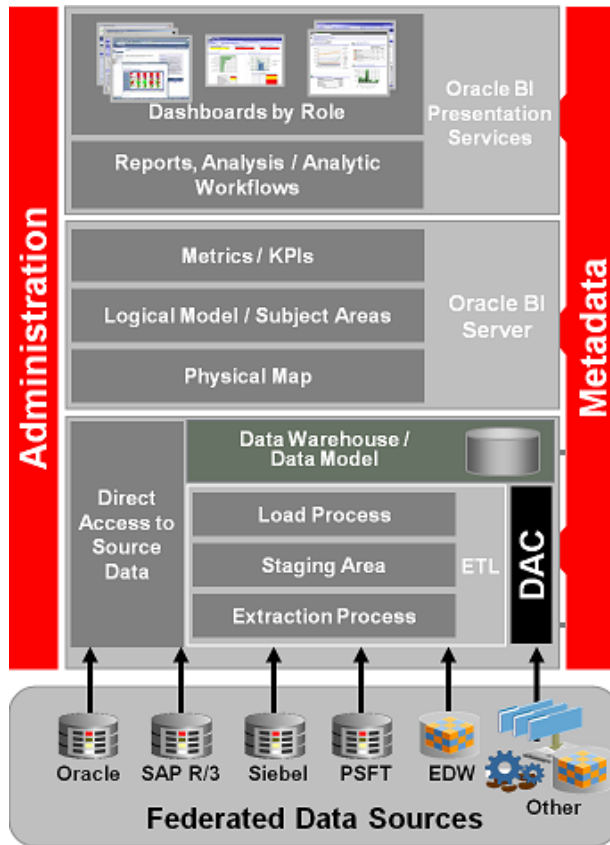
Goal

- Systematic improvement of the environment
- User experience top priority

Approach



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Work Top Down

- Catalog
- RPD
- Database
- Infrastructure



Process

- Have users show us their problem children
- Look at the analyses under the hood
- Analyze -
 - Logical and physical SQL being generated
 - RPD
 - Warehouse schema objects
 - Database and middle tier configuration
 - Hardware
- Establish good baselines



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Baselines



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- Set a good before baselines!

1 Average	Premise Excess Inventory	4.1
2 Average	Inventory Balance Prev to Current Top N Part changes FG	6.8
3 Average	Inventory Balance Reporting Last Full Month_Agg	30.4
4 Average	USAC Inventory Values_Agg	26.9
5 Average	ACS On Hand Inventory_Agg	14.9
6 Average	ACS WOP Value	0.9
7 Average	FGI Inventory_Agg	0.8
8 Average	GL Scrap Cable Graph YEARS_NeedsRewrite	249.4
9 Average	SCRAP_NeedsRewrite	134.5
10 Average	SCRAP years_NeedsRewrite	93.7
11 Average	OCA Expense Details - GL Balance Sheet_Agg	55.8
13 Average	P & L Report Trend ACS 4_Agg	25.4



What did we find?

?

Database parameter – MK_OBI_GO_FAST was set to NO



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Infrastructure & Configuration



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- No evidence that they were wildly under resourced
- Parameters and configuration conform to guides for most part

```
Initializing WebLogic Scripting Tool (WLST) ...

Welcome to WebLogic Server Administration Scripting Shell

Type help() for help on available commands

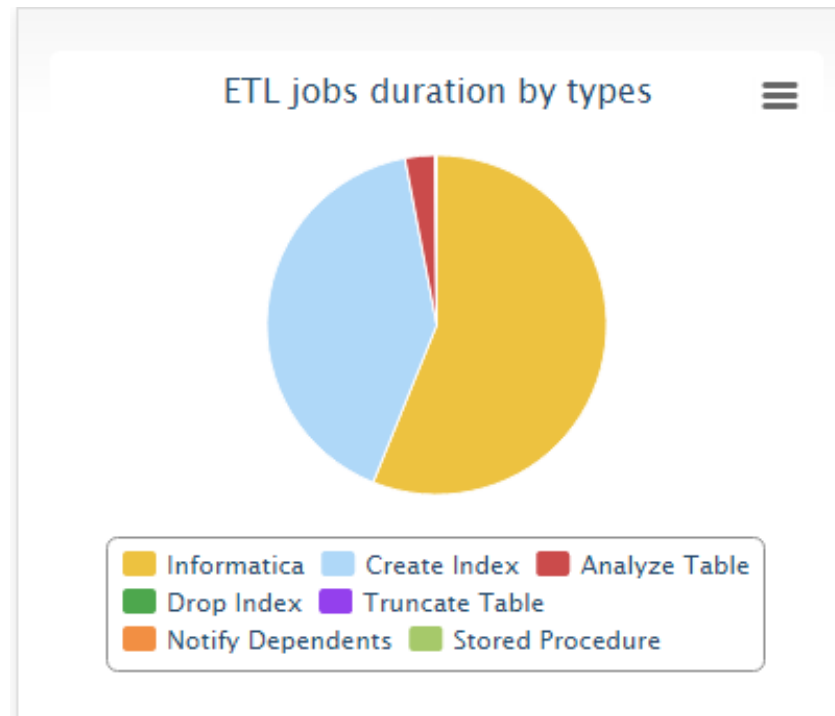
--- Reading properties file tuningGuide.properties ---
tcp_fin_timeout=/proc/sys/net/ipv4/tcp_fin_timeout
WLPassword=*****
limitsconf=/etc/security/limits.conf
WLstUrl=t3://localhost:8001
httpdconf=/oracle/user_projects/epmsystem1/httpConfig/ohs/config/OHS/ohs_component/httpd.conf
tcp_max_syn_backlog=/proc/sys/net/ipv4/tcp_max_syn_backlog
essbase_application_log=/oracle/bi/instances/instance1/diagnostics/logs/Essbase/essbaseserver1/essbase/app/BISAMPLE/BISAMPLE.log
mod_wl_ohsconf=/oracle/user_projects/epmsystem1/httpConfig/ohs/config/OHS/ohs_component/mod_wl_ohs.conf
WLUsername=weblogic
solaris_system=/etc/system
essbase_cfg=/oracle/bi/instances/instance1/Essbase/essbaseserver1/bin/essbase.cfg
sslconf=/oracle/user_projects/epmsystem1/httpConfig/ohs/config/OHS/ohs_component/ssl.conf

--- OS where wlst is running ---
os.name : Linux
os.arch : amd64
os.version : 2.6.32-300.21.1.el5uek
```

NAME	VALUE
active_instance_count	1
aq_tm_processes	0
archive_lag_target	0
asm_diskgroups	1
asm_diskstring	
asm_power_limit	1

ETL

- Bottlenecks
 - Indexes
 - Lookups
 - Concurrency
 - I/O



- Time spent on unused indexes and aggregates



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Physical Analysis



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- Review of indexes, row counts and distinct keys
- Troype APE Diagnostics Software used

Indexes ▾

Index Name Index Owner

Table Name

10 records per page Show / hide columns

INDEX NAME	INDEX TYPE	UNIQUENESS	LEAF BLOCKS	DISTINCT KEYS	CLUSTERING FACTOR	LAST ANALYZED
SYS_IL0005577974C00012\$	LOB	UNIQUE	0	0	0	
SYS_IL0005577977C00004\$	LOB	UNIQUE	0	0	0	
_W_PROD_XACT_ACT_F8800	BITMAP	NONUNIQUE	2 367	0	5 530	12/27/2015 05:42:47 AM
_W_PROD_XACT_ACT_F7500	BITMAP	NONUNIQUE	2 367	0	5 530	12/27/2015 05:47:16 AM
_W_PROD_XACT_ACT_F8600	BITMAP	NONUNIQUE	2 367	0	5 530	12/27/2015 05:42:39 AM
_W_PROD_XACT_ACT_F8700	BITMAP	NONUNIQUE	2 367	0	5 530	12/27/2015 05:42:42 AM
_W_PRD_XACT_ACTS_PF_U1	NORMAL	NONUNIQUE	0	0	0	12/27/2015 05:51:14 AM
W_PROD_XACT_F_M98	BITMAP	NONUNIQUE	0	0	0	12/27/2015 05:51:14 AM
_W_PRD_XACT_PF_N1	BITMAP	NONUNIQUE	0	0	0	12/27/2015 05:51:14 AM
_W_PROD_XACT_ACT_F7800	BITMAP	NONUNIQUE	2 367	0	5 530	12/27/2015 05:47:27 AM

Showing 1 to 10 of 3,120 entries

Statistics Requests Init Blocks Concurrency Gantt Users Database

Tables ▾

Table Name Table Owner

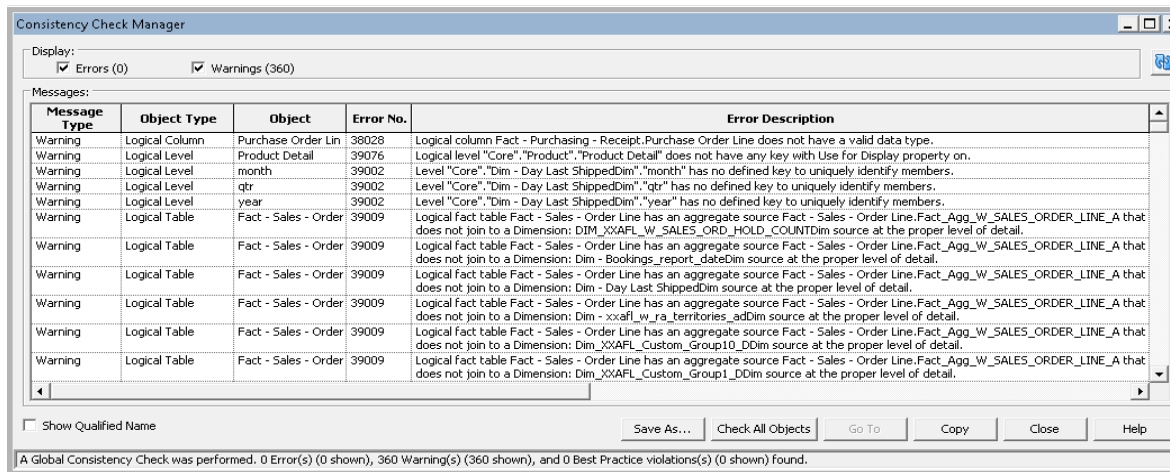
5 records per page Show / hide columns

TABLE NAME	ROWS	BLOCKS	CHAINED ROWS	PARTITIONED	COMPRESSION	DEGREE	INDEXES	LAST ANALYZED
_W_SALES_ORDER_LINE_V_F	1 628 576	217 786	1 625 260	No	No	8	53	01/01/2016 05:01:20 AM
MTL_SYSTEM_ITEMS_B_TEMP	824 723	4 198	196 377	No	No	1	1	12/27/2015 02:03:31 AM
W_SALES_INVOICE_LINE_F	5 186 144	539 890	32 445	No	No	8	50	01/01/2016 05:01:14 AM
_W_MTL_CATEGORIES_ADS	286 584	6 544	7 940	No	No	1	1	01/01/2016 04:42:44 AM
_QLT_FIBER_DATA_F	269 734	22 332	7 723	No	No	1	8	01/01/2016 01:41:53 AM

Showing 1 to 5 of 260 entries

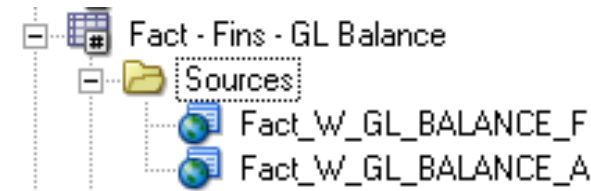
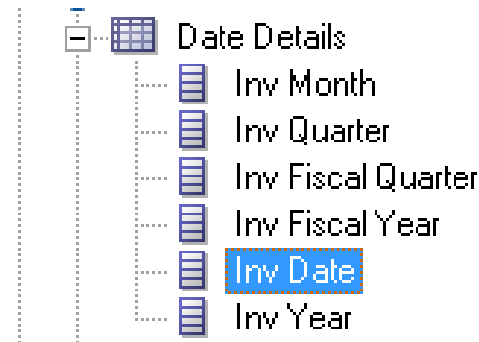
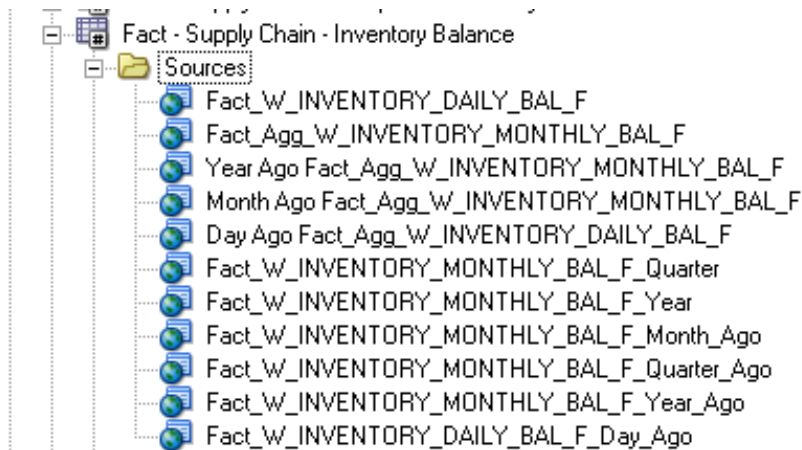
TABLE NAME	ROWS
W_PRODUCT_XACT_PF	99 311 748
W_INVENTORY_DAILY_BAL_F	47 888 706
XXAFL_W_PRODUCT_XACT_ACCTS_PF	32 533 388
W_GL_OTHER_F	17 854 452
XXAFL_W_WIP_TRANSACTIONS_F	17 218 831
W_GL_OTHER_F_07092015	16 062 634
TMP_W_PRODUCT_XACT	15 817 233
W_GL_LINKAGE_INFORMATION_G	14 248 823
XXAFL_QLT_FIN_ASS_TESTS_F	13 181 120
XXAFL_W_WIP_PERIOD_BALANCES_F	11 763 447
XXAFL_W_WIP_ENTITIES_D	11 171 120
W_GL_BALANCE_F	9 858 492
W_GL_BALANCE_A	9 186 076

- Excessive warnings in RPD
 - 350+ warning right out of the box
- A nice to have!



RPD

- Dimensions
- Facts
- Aggregate navigation
- Proper aggregate tables

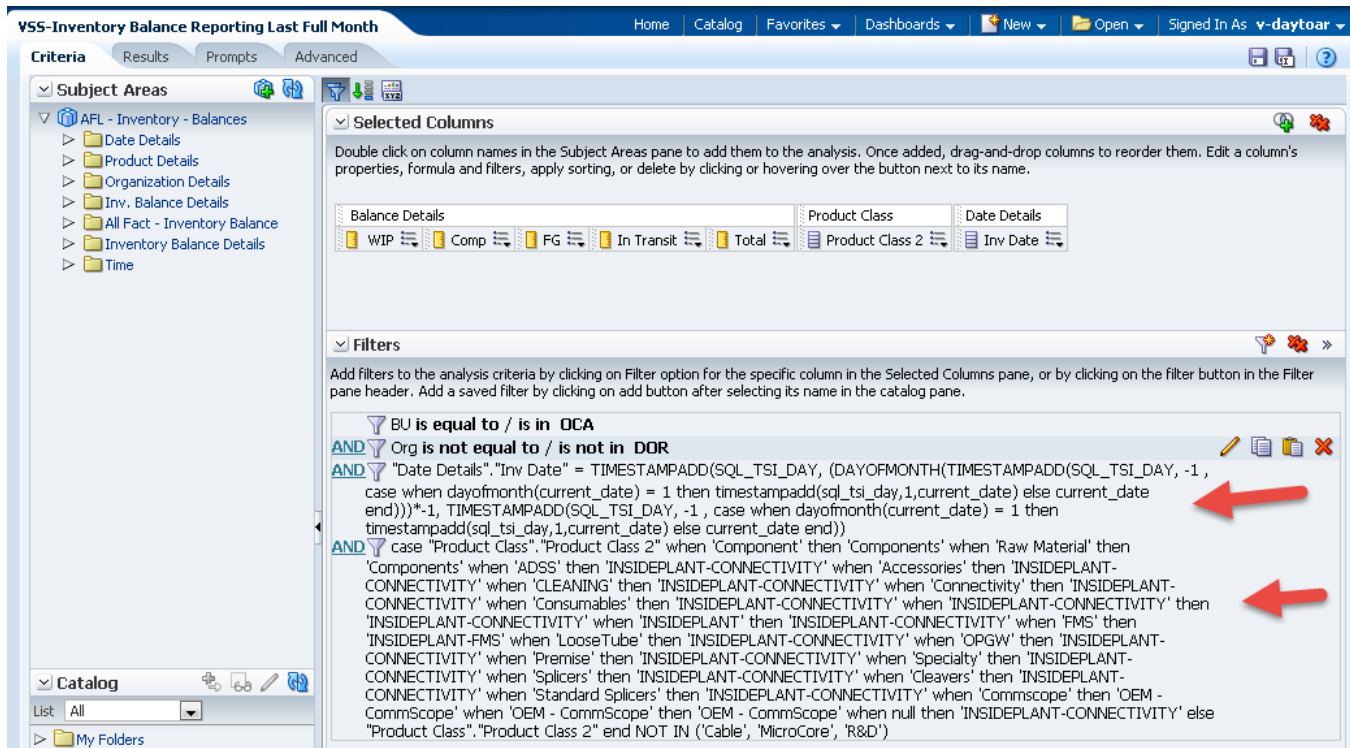


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Unnecessary Complex Predicates



VSS-Inventory Balance Reporting Last Full Month

Home Catalog Favorites Dashboards New Open Signed In As v-daytoar

Criteria Results Prompts Advanced

Subject Areas

- ▼ AFL - Inventory - Balances
 - ▼ Date Details
 - ▼ Product Details
 - ▼ Organization Details
 - ▼ Inv. Balance Details
 - ▼ All Fact - Inventory Balance
 - ▼ Inventory Balance Details
 - ▼ Time

Selected Columns

Double click on column names in the Subject Areas pane to add them to the analysis. Once added, drag-and-drop columns to reorder them. Edit a column's properties, formula and filters, apply sorting, or delete by clicking or hovering over the button next to its name.

Balance Details	Product Class	Date Details
WIP	Product Class 2	Inv Date
Comp		
FG		
In Transit		
Total		

Filters

Add filters to the analysis criteria by clicking on Filter option for the specific column in the Selected Columns pane, or by clicking on the filter button in the Filter pane header. Add a saved filter by clicking on add button after selecting its name in the catalog pane.

BU is equal to / is in OCA

AND Org is not equal to / is not in DOR

AND "Date Details". "Inv Date" = TIMESTAMPADD(SQL_TSI_DAY, (DAYOFMONTH(TIMESTAMPADD(SQL_TSI_DAY, -1, case when dayofmonth(current_date) = 1 then timestampadd(sql_tsi_day,1,current_date) else current_date end)))*-1, TIMESTAMPADD(SQL_TSI_DAY, -1, case when dayofmonth(current_date) = 1 then timestampadd(sql_tsi_day,1,current_date) else current_date end))

AND case "Product Class", "Product Class 2" when 'Component' then 'Components' when 'Raw Material' then 'Components' when 'ADSS' then 'INSIDEPLANT-CONNECTIVITY' when 'Accessories' then 'INSIDEPLANT-CONNECTIVITY' when 'CLEANING' then 'INSIDEPLANT-CONNECTIVITY' when 'Connectivity' then 'INSIDEPLANT-CONNECTIVITY' when 'Consumables' then 'INSIDEPLANT-CONNECTIVITY' when 'INSIDEPLANT-CONNECTIVITY' then 'INSIDEPLANT-CONNECTIVITY' when 'INSIDEPLANT' then 'INSIDEPLANT-CONNECTIVITY' when 'FMS' then 'INSIDEPLANT-FMS' when 'LooseTube' then 'INSIDEPLANT-CONNECTIVITY' when 'OPGW' then 'INSIDEPLANT-CONNECTIVITY' when 'Premise' then 'INSIDEPLANT-CONNECTIVITY' when 'Specialty' then 'INSIDEPLANT-CONNECTIVITY' when 'Splicers' then 'INSIDEPLANT-CONNECTIVITY' when 'Cleavers' then 'INSIDEPLANT-CONNECTIVITY' when 'Standard Splicers' then 'INSIDEPLANT-CONNECTIVITY' when 'Commscope' then 'OEM - CommScope' when 'OEM - CommScope' then 'OEM - CommScope' when null then 'INSIDEPLANT-CONNECTIVITY' else 'Product Class', 'Product Class 2' end NOT IN ('Cable', 'MicroCore', 'R&D')

Catalog

List All

My Folders



More Unnecessary Complex Predicates

Column Formula Bins

Folder Heading: Product Class
Column Heading: Product Class 2
☒ Custom Headings
☐ Contains HTML Markup
Aggregation Rule (Totals Row): Default (None)

Available

Subject Areas

- ▼ AFL - Inventory - Balances
 - ▶ Date Details
 - ▶ Product Details
 - ▶ Organization Details
 - ▶ Inv. Balance Details
 - ▶ All Fact - Inventory Balance
 - ▶ Inventory Balance Details
 - ▶ Time

Column Formula

```
case "Product Class","Product Class 2" when 'Component' then
'Components' when 'Raw Material' then 'Components' when 'ADSS' then
'INSIDEPLANT-CONNECTIVITY' when 'Accessories' then 'INSIDEPLANT-
CONNECTIVITY' when 'CLEANING' then 'INSIDEPLANT-CONNECTIVITY'
when 'Connectivity' then 'INSIDEPLANT-CONNECTIVITY' when
'Consumables' then 'INSIDEPLANT-CONNECTIVITY' when 'INSIDEPLANT-
CONNECTIVITY' then 'INSIDEPLANT-CONNECTIVITY' when
'INSIDEPLANT' then 'INSIDEPLANT-CONNECTIVITY' when 'FMS' then
'INSIDEPLANT-FMS' when 'LooseTube' then 'INSIDEPLANT-
CONNECTIVITY' when 'OPGW' then 'INSIDEPLANT-CONNECTIVITY'
when 'Premise' then 'INSIDEPLANT-CONNECTIVITY' when 'Specialty'
then 'INSIDEPLANT-CONNECTIVITY' when 'Splicers' then 'INSIDEPLANT-
CONNECTIVITY' when 'Standard Splicers' then 'INSIDEPLANT-CONNECTIVITY' when
'Commscope' then 'OEM - CommScope' when 'OEM - CommScope' then
'OEM - CommScope' when null then 'INSIDEPLANT-CONNECTIVITY' else
'Product Class',"Product Class 2" end
```

Column Formula Bins

Folder Heading: Balance Details
Column Heading: Total
☒ Custom Headings
☐ Contains HTML Markup
Aggregation Rule (Totals Row): Sum

Available

Subject Areas

- ▼ AFL - Inventory - Balances
 - ▶ Date Details
 - ▶ Product Details
 - ▶ Organization Details
 - ▶ Inv. Balance Details
 - ▶ All Fact - Inventory Balance
 - ▶ Inventory Balance Details
 - ▶ Time

Column Formula

```
IFNULL("Inv. Balance Details","WIP Amt",0)+IFNULL(FILTER("Inv. Balance
Details","STD Cost Amt" USING ("Organization Details","Org" || " " ||
"Subinventory","Sub Name" in (LDC-OFFSITE,"MTY-CABLE","MTY-CONSIGNED",
"MTY-CONSUMABLE","MTY-LOCALREC","MTY-MRB","MTY-MRBRROTRAN","MTY-OPS",
"MTY-RAWSTORES","MTY-RETRABAJO","MTY-SCRAP","MTY-SHOPFLOOR",
"NRT-JDSU CELL","NRT-RAWSTORES","SMY-CABLE","SMY-CONSIGNED",
"SMY-CONSUMABLE","SMY-MRB","SMY-MRBRROTRAN","SMY-OPS",
"SMY-RAWSTORES","SMY-RETRABAJO","SMY-SCRAP","SMY-SHOPFLOOR",
"LAB-FSV","LAB-MRB","LAB-RAWSTORES","DOR-OFFSITE","DOR-RAWSTORES",
"DOR-WAREHOUSE","LAB-OSP","DOR-MRB","DOR-QA HOLD","DOR-SHOPFLOOR",
"BRN-RAWSTORES","BRN-SHOPFLOOR","BRN-UPS2","BRN-MRB","LAB-FEEL",
"LAB-XDK"))),0)+IFNULL(FILTER("Inv. Balance Details","STD Cost Amt" USING
("Organization Details","Org" || " " || "Subinventory","Sub Name" in (LDC-DROP
SHIP,"LDC-FIBEREXT","LDC-FWCONSIGN","LDC-MRB","LDC-RAWSTORES",
"LDC-SMOG","LDC-SLONCO","MTY-BUY/RESALE","MTY-SHIPPING","MTY-SUBASSY",
"NRT-FG","NRT-MRB","SMY-BUY/RESALE","SMY-SHIPPING","SMY-SUBASSY",
"LAB-SHIPPING","DOR-SHIPPING","BRN-SHIPPING","LDC-COMPSOL",
"LDC-HILLSIDE))),0)+Case case "Product Class","Product Class 2" when
'Component' then 'Components' when 'Raw Material' then 'Components' when
'ADSS' then 'INSIDEPLANT-CONNECTIVITY' when 'Accessories' then 'INSIDEPLANT-
CONNECTIVITY' when 'CLEANING' then 'INSIDEPLANT-CONNECTIVITY' when
'Connectivity' then 'INSIDEPLANT-CONNECTIVITY' when 'Consumables' then
'INSIDEPLANT-CONNECTIVITY' when 'INSIDEPLANT-CONNECTIVITY' then
'INSIDEPLANT-CONNECTIVITY' when 'FMS' then 'INSIDEPLANT-FMS' when
'LooseTube' then 'INSIDEPLANT-CONNECTIVITY' when 'OPGW' then 'INSIDEPLANT-
CONNECTIVITY' when 'Premise' then 'INSIDEPLANT-CONNECTIVITY' when
'Specialty' then 'INSIDEPLANT-CONNECTIVITY' when 'Splicers' then 'INSIDEPLANT-
CONNECTIVITY' when 'Commscope' then 'OEM - CommScope' when 'OEM -
CommScope' then 'OEM - CommScope' when null then 'INSIDEPLANT-
CONNECTIVITY' else "Product Class","Product Class 2" end when "Customer
Premises" then IFNULL("Inv. Balance Details","In Transit Amt",0) +
@ (CompInTransExtra)(0) when 'OEM - CommScope' then IFNULL("Inv. Balance
Details","In Transit Amt",0) + @ (OEMCommInTransExtra)(0) else IFNULL("Inv.
Balance Details","In Transit Amt",0) end
```

Result of complex predicates



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```
WITH SAWITH0 AS (select sum(T91940.UNIT_STD_COST *  
T91940.IN_TRANSIT_QTY * T91940.GLOBAL1_EXCHANGE_RATE) as c3,  
sum(case  
  when concat(concat(T95031.BUSN_LOC_NUM,  
    '-'),  
    substr(T94704.PARENT_LOC_NUM ,  
    5)) in ('BRN-MRB',  
    'BRN-RAWSTORES',  
    'BRN-SHOPFLOOR',  
    'BRN-UPS2',  
    'DOR-MRB',  
    'DOR-OFFSITE',  
    'DOR-QA HOLD',  
    'DOR-RAWSTORES',  
    'DOR-SHOPFLOOR',  
    'DOR-WAREHOUSE',....  
    'LAB-FETL',  
    'LAB-FOV',  
    'LAB-MRB',  
    'LAB-OSP',  
    'LAB-RAWSTORES',  
    'LAB-XDK',  
    'LDC-OFFSITE',  
    'MTV CABLE'
```



What did we do?

- Properly configured dimension levels in RPD
 - Time Hierarchies
- Turned complex case statements into a dimension
- Built an aggregate table
- Reworked the indexing strategy
- Exposed proper fields for aggregate navigation
- Laid out plan for continuous improvement

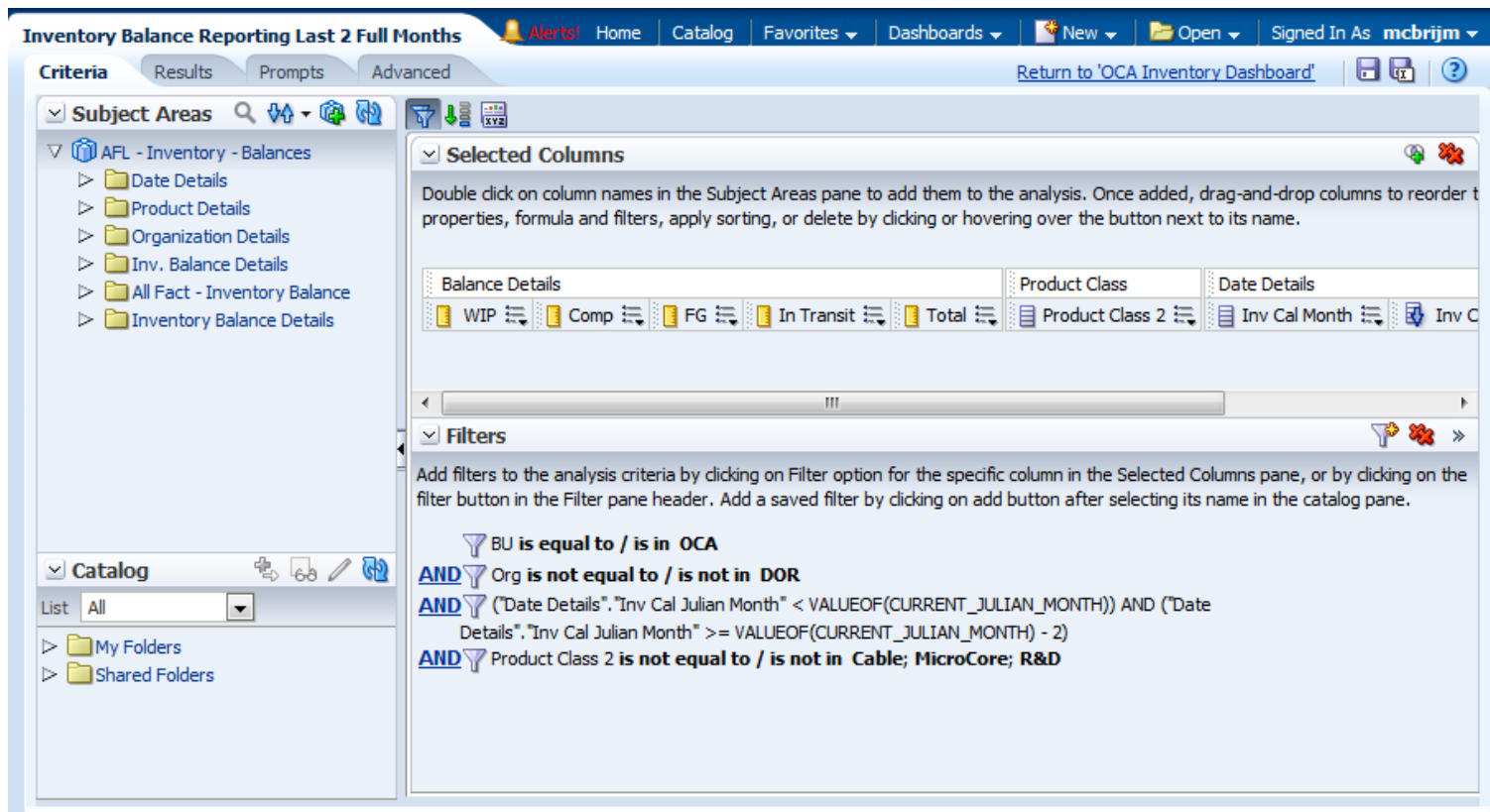


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Improved Predicates



Inventory Balance Reporting Last 2 Full Months Alerts! Home Catalog Favorites Dashboards New Open Signed In As mcbrijm

Criteria Results Prompts Advanced [Return to 'OCA Inventory Dashboard'](#)

Subject Areas

- ▼ AFL - Inventory - Balances
 - ▼ Date Details
 - ▼ Product Details
 - ▼ Organization Details
 - ▼ Inv. Balance Details
 - ▼ All Fact - Inventory Balance
 - ▼ Inventory Balance Details

Selected Columns

Double click on column names in the Subject Areas pane to add them to the analysis. Once added, drag-and-drop columns to reorder the properties, formula and filters, apply sorting, or delete by clicking or hovering over the button next to its name.

Balance Details					Product Class	Date Details
WIP	Comp	FG	In Transit	Total	Product Class 2	Inv Cal Month

Filters

Add filters to the analysis criteria by clicking on Filter option for the specific column in the Selected Columns pane, or by clicking on the filter button in the Filter pane header. Add a saved filter by clicking on add button after selecting its name in the catalog pane.

- ▼ BU is equal to / is in OCA
- AND ▼ Org is not equal to / is not in DOR
- AND ▼ ("Date Details", "Inv Cal Julian Month" < VALUEOF(CURRENT_JULIAN_MONTH)) AND ("Date Details", "Inv Cal Julian Month" >= VALUEOF(CURRENT_JULIAN_MONTH) - 2)
- AND ▼ Product Class 2 is not equal to / is not in Cable; MicroCore; R&D

Catalog

List All

- ▼ My Folders
- ▼ Shared Folders



Results



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SAW_SRC_PATH	Baseline	Spot Check	Change	% Change
Premise Excess Inventory	4.1	2.8	1.4	34%
Inventory Balance Prev to Current Top N Part changes FG	6.8	1.9	4.9	72%
Inventory Balance Reporting Last Full Month_Agg	30.4	0.5	29.9	98%
USAC Inventory Values_Agg	26.9	-	26.9	100%
ACS On Hand Inventory_Agg	14.9	5.0	9.9	66%
ACS WOP Value	0.9	1.0	(0.1)	-6%
FGI Inventory_Agg	0.8	3.5	(2.7)	-338%
GL Scrap Cable Graph YEARS_NeedsRewrite	249.4	6.0	243.4	98%
SCRAP_NeedsRewrite	134.5	109.0	25.5	19%
SCRAP years_NeedsRewrite	93.7	87.0	6.7	7%
OCA Expense Details - GL Balance Sheet_Agg	55.8	14.4	41.4	74%
P & L Report Trend ACS 4_Agg	25.4	1.1	24.2	95%

Conclusions

- Don't try to eat the whole elephant at once
- Look for the simple solutions first
- Move the heavy lifting away from the catalog
- Prioritize
- Start at the top
- It's probably you



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Sources for performance tuning



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**OBIEE 11g Infrastructure Performance Tuning Guide
(Doc ID 1333049.1)**

**Oracle Business Intelligence Applications Version 7.9.6.x
Performance Recommendations
(Doc ID 870314.1)**

**Oracle Business Intelligence Applications Version 11g
Performance Recommendations
(Doc ID 1963225.1)**

Database Performance Tuning Guide

Database Data Warehousing Guide

<http://www.odtug.com/bi>



Case Study of Improving BI Apps and OBIEE Performance

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