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Performance Optimization for ABAP CDS view

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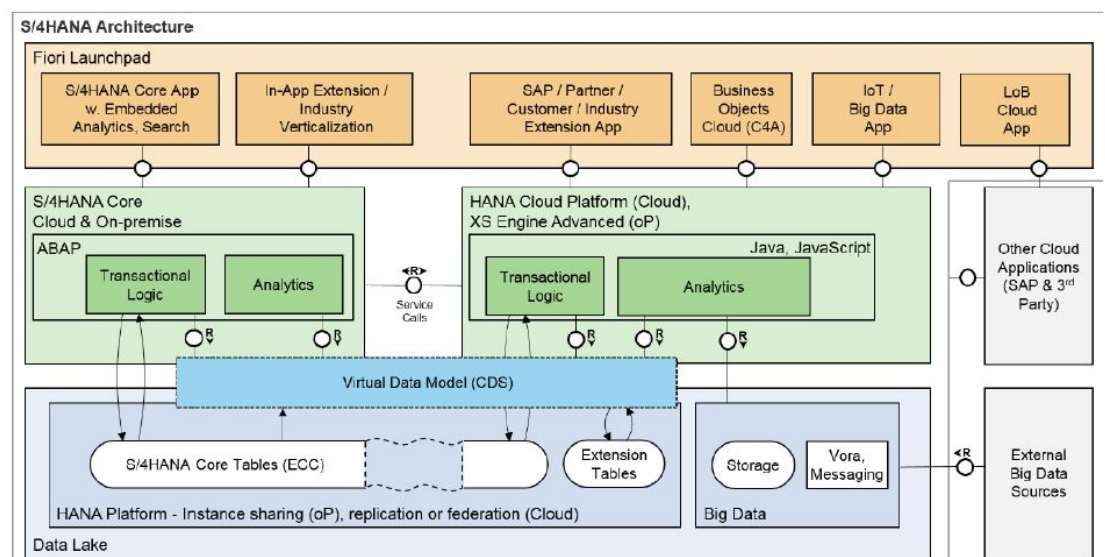
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Topic : The blog will discuss on the Topic of Performance optimization for CDS views.

As an ABAP CDS view developer working in S/4HANA projects, Please find the points we need to check while developing the view.

General Architecture for SAP S/4HANA:



The diagram illustrates the HANA SQL Processor workflow, which consists of the following steps:

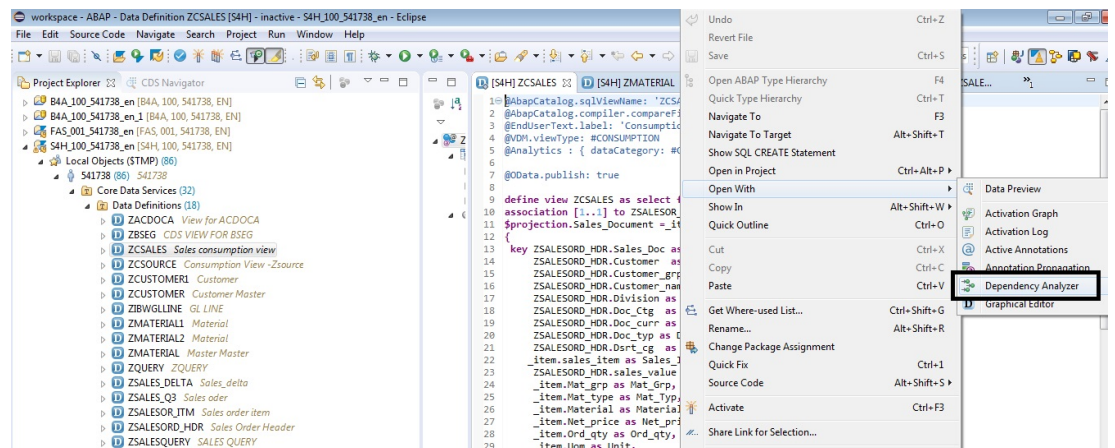
- Parsing**
- Logical plan rewriting**
- Logical plan enumeration**
- Physical algorithm enumeration**
- Cost-based best plan selection**
- Execution plan**
- Runtime compilation**

Below the workflow, three examples are provided:

- SELECT clause, WHERE clause, FROM clause:** A vertical list of three orange circles representing the components of a SQL query.
- Single logical plan:** A tree diagram showing a root node J3 connected to J1 and J2. J1 is connected to T1, T2, and T3. J2 is connected to T4. The nodes are labeled with their IDs (J1, J2, J3, T1, T2, T3, T4).
- Logical plan forest / plan search space / alternative plans:** A complex graph showing multiple possible logical plans. It includes nodes J1, J2, J3, J4, J5, J6, J7, J8, J9, J10 and tables T1, T2, T3, T4. The connections represent different ways to join the tables.
- Execution plan / cached plan / physical plan:** A tree diagram showing a specific execution plan. The root node J2 is connected to J1 and J3. J1 is connected to T2, T1, and T4. J3 is connected to T3. The nodes are labeled with their IDs (J1, J2, J3, T1, T2, T3, T4).

- 1.CDS views stacking can get so complex that it results in performance degradation
- 2.Number of execution plan variants raises according (#?????)?HANA optimizer could fail to find the optimal execution plan.
- 3.By using layered CDS views, formerly fast accesses to buffered tables and application caches on ABAP server might be replaced by complex database accesses
- 4.Declarative programming style of SQL can have a performance drawback since optimizer plans do not take into account the actual attributes of a statement. Cutting away unnecessary execution branches might not be done with the same efficiency as with imperative programming in ABAP

ADT (ABAP Development Tools for Eclipse) > Open with Dependency Analyzer.



VIR_C_SALESORDERITEM -> [CCQ] SEPMRA_C_SALESORDERITEM 31				
Dependency Tree				
	SQL Relation	Object Type	Entity Name	Database
IACSOI		CDS View (STORE)	SEPMRA_C_SalesOrderItem	True
SEPMRA_SOWO	From	CDS View (STORE)	SEPMRA_I_SalesOrderItemUID	True
SEPMRA_SOWO	From	CDS View (STORE)	SEPMRA_P_SalesOrderItemUID	True
SELECT				
SEPM_SOE	From	CDS View (STORE)	SEPM_I_SalesOrderItem_E	True
SEPM_USOI	From	CDS View (STORE)	SEPM_I_SalesOrderItem	True
SNWD_SO_I	From	Database Table (TA...		True
SEPM_PRODUCT	Left Outer Join	CDS View (STORE)	SEPM_I_Product	True
SNWD_PD	From	Database Table (TA...		True
SEPM_ISO	Left Outer Join	CDS View (STORE)	SEPM_I_SalesOrder	True
SNWD_SO	From	Database Table (TA...		True
SEPMRA_SOD	Left Outer Join	CDS View (STORE)	SEPMRA_I_SalesOrderItemDraft	True
SEPMRA_SODRAFT	From	Database Table (TA...		True
SDRAFT_ADMIN_CDS	Inner Join	CDS View (STORE)	I_DraftAdministrativeData	True
SDRAFT_ADMIN	From	Database Table (TA...		True
USR21	Inner Join	Database Table (TA...		True
USR21	Inner Join	Database Table (TA...		True
USR21	Left Outer Join	Database Table (TA...		True
UNION ALL				
SEPMRA_SOD	From	CDS View (STORE)	SEPMRA_I_SalesOrderItemDraft	True
SEPMRA_SODRAFT	From	Database Table (TA...		True
SDRAFT_ADMIN_CDS	Inner Join	CDS View (STORE)	I_DraftAdministrativeData	True
SDRAFT_ADMIN	From	Database Table (TA...		True
USR21	Inner Join	Database Table (TA...		True
USR21	Inner Join	Database Table (TA...		True
USR21	Left Outer Join	Database Table (TA...		True

Note :

Separate transactional data, master data, org data, customizing, and other metadata This is important to leverage caches on the application server for meta data.

Classification of CDS views using performance annotations :

@ObjectModel.usageType.serviceQuality

quality of service with respect to the expected performance of the CDS view

@ObjectModel.usageType.dataClass

type of data in CDS view (transactional data, master data, ...)

@ObjectModel.usageType.sizeCategory

set of data which has to be searched through in order to compute the result set

```

6 @AccessControl.authorizationCheck: #CHECK
7 @ObjectModel.usageType.serviceQuality: 'D'
8 @ObjectModel.usageType.sizeCategory: 'XL'
9 @ObjectModel.usageType.dataClass: 'CUSTOMIZING'
10 @ClientHandling.algorithm: #SESSION_VARIABLE

```

CDS views: performance annotations

serviceQuality	Each CDS view shall be assigned to one of the following quality categories: A: the view may be consumed within business logic for high volume transactions or background processing B: the view may be consumed within business logic for transactions or background processing C: the view may be consumed from the UI in transactions for single object retrieval D: the view may be consumed for analytical reporting X: the view is built to push down application code to HANA
sizeCategory	Each CDS view shall have assigned a size category. The size category enables the consumer to judge the possible result set. It reflects the number of rows that has to be searched through to get a result. The labels correspond to the following size categories (expected number of rows in customer production systems): S < 1000, M < 100.000, L < 10.000.000, XL < 100.000.000, XXL > 100.000.000
dataClass	To support the decision on cache strategies for higher layers and to enable client side statement routing using these caches, each CDS view shall have assigned a data class. The different data classes correspond to different life time cycles. TRANSACTIONAL data is written or changed in high volume transactions MASTER data is read, but not written or changed in high volume transactions ORGANIZATIONAL data describes the organizational structure of a company and its business processes CUSTOMIZING data describes how a concrete business process is executed at the customer META data specifies how the system is configured or describes the technical structure of entities MIXED data shall be chosen if the CDS-View contains tables with several different of the above types

service-Quality of CDS views: requirements and KPIs:

service Quality	Usage	size Category	Expected dataClass	Number of tables	Functions	Aggregation	Data Classes	Buffering	Testing	SELECT fld FROM view WHERE key LIMIT 1	SELECT * FROM view WHERE key LIMIT 1
A	may be consumed within business logic for high volume transactions or background processing	S, M, L, XL or XXL	transactional, master, customizing, org, meta, but not mixed	≤ 3	no	no	all identical	buffered when all underlying tables buffered	Automatic generic	< 1ms	< 2ms
B	may be consumed within business logic for transactions or background processing			≤ 5	only if applied to result set (conversions)					< 2ms	< 5ms
C	may be consumed from the UI in transactions for single object retrieval , may not be used within application logic.		mixed	≤ 15		no aggregation of a huge number of table rows				< 10ms	< 20ms
D	may be consumed for analytical reporting	XXL	mixed	< 100					Manual	define realistic test case on realistic test data and define KPIs (default < 500ms)	
X	is built to push down application code to HANA									As class D or improved performance and throughput compared to implementation without code push-down	

Generate SQL statement for CDS Views:

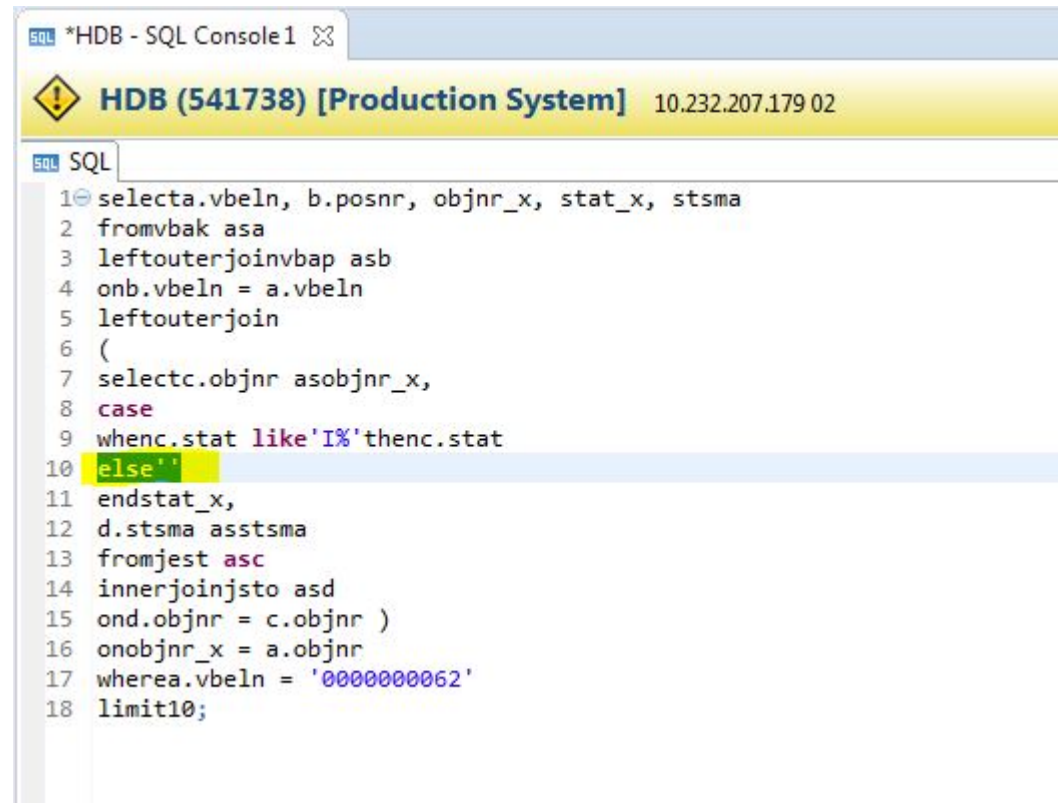
ADT (ABAP Development Tools for Eclipse)> View SQL statement.

SQL Tips :

Exposed non NULL preserving calculated field

The blow example 2. Result 385% improvement of Query execution :

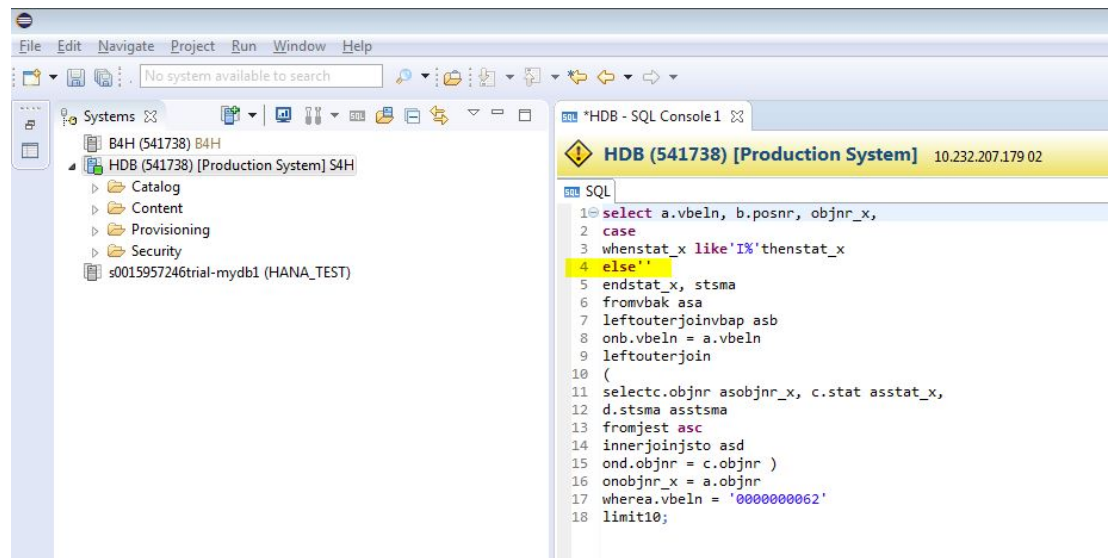
Example 1: The output time was 883 ms



The screenshot shows the SAP HDB SQL Console interface. At the top, there's a header bar with a yellow background containing a warning icon, the text "HDB (541738) [Production System]", and the IP address "10.232.207.179 02". Below this, the "SQL" tab is active, displaying a SQL query. The query is a complex join operation involving several tables and a subquery. Line 10, containing the "else" keyword, is highlighted in yellow. The query ends with a "limit 10;" statement.

```
1 select a.vbeln, b.posnr, objnr_x, stat_x, stsmas  
2 from vbak as a  
3 left outer join vbap as b  
4   on b.vbeln = a.vbeln  
5 left outer join  
6   (  
7     select c.objnr as objnr_x,  
8     case  
9       when c.stat like 'I%' then c.stat  
10    else ' '  
11   end as stat_x,  
12   d.stsmas as stsmas  
13   from jst asc  
14   inner join jsto as d  
15   on d.objnr = c.objnr )  
16   on objnr_x = a.objnr  
17 where a.vbeln = '0000000062'  
18 limit 10;
```

Example 2: The output time was 34 ms



Limit push down and aggregation push down :

- Order by: first sort, then limit →problem for calculated fields
- Distinct operator, any aggregation
- cardinality changing joins (e.g. LoJoin TO MANY)

Rounding (and other functions) stop optimizer from pushing down aggregations
 Currency conversion and all arithmetic operations except +/-contain implicit rounding functions

Special Note on Performance Recommendation:-

1. Keep CDS views simple (in particular service-Quality A and B = #BASIC views)
2. Amount of data persisted in S4 CDS views should not exceed 20% of the overall data volume of the system.
3. In transactional processing, only use simple CDS views accessed via CDS key
4. Expose only required fields –define associations to reach additional fields when requested
5. Perform expensive operations (e.g. calculated fields) after data reduction (filtering, aggregation)
6. Avoid joins and filters on calculated fields
7. Test performance of CDS views. Test with reasonable (= realistic) test data
8. Analyze accesses to more complex views with HANA PlanViz to see whether filters are pushed down to all branches.
9. Stay tuned on caching possibilities of SAP HANA and Fiori apps

Assigned tags

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SAP Fiori for SAP S/4HANA

embedded analytics

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5 Comments

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Vivek Tripathi

July 3, 2018 at 7:04 am

Well explained Prosenjit....

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Vikash C Agrawal

July 10, 2018 at 8:44 am

Very well thought out blog. Thanks.

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Prosenjit Das Neogi | Blog Post Author

July 10, 2018 at 7:41 pm

Thanks Sir

Like 0 | Share

Randolf Eilenberger

January 18, 2019 at 7:50 am

Hi Prosenjit,

Your blog seems to have been influenced by session [S4H300 – Boost Performance for CDS Views on SAP HANA](#) at TechEd 2017 ([View the presentation \(PDF\)](#)). Currently I publish a series of blog posts [Safeguard Performance of ABAP CDS Views](#), which might also be interesting for you and your readers.

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Martin Sommer

March 22, 2021 at 7:25 am

Hi Randolph, can you please repair the link to the presentation PDF? Best regards

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