# WELCOME

# How to Find Unused Oracle Database Objects and Subprograms

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BASEL BERN BRUGG LAUSANNE ZÜRICH DÜSSELDORF FRANKFURT A.M. FREIBURG I.BR. HAMBURG MÜNCHEN STUTTGART WIEN







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# About Me

- With Trivadis since April 2000
  - Senior Principal Consultant, Partner
  - Member of the Board of Directors
  - philipp.salvisberg@trivadis.com
  - www.salvis.com/blog
- Member of the trivadis performanceteam


- Main focus on database centric development with Oracle DB
  - Application Development
  - Business Intelligence
  - Application Performance Management
- Over 20 years experience in using Oracle products

# AGENDA

1. Background
2. Finding Unused Objects
3. Finding Unused Sub-Objects
4. Core Messages

# Advertising Business

- Posters, eBoards, ePanels
  - in streets
  - in train stations
  - at bus stops
  - in parking lots
  - in shopping centers
  - in tourist resorts
  - in airports
  - in and on vehicles
  - on buildings
- APG|SGA, End of 2012
  - Sales revenue in CH: MCHF 297.1
  - Net income:  MCHF 50.0
  - Employees: 652








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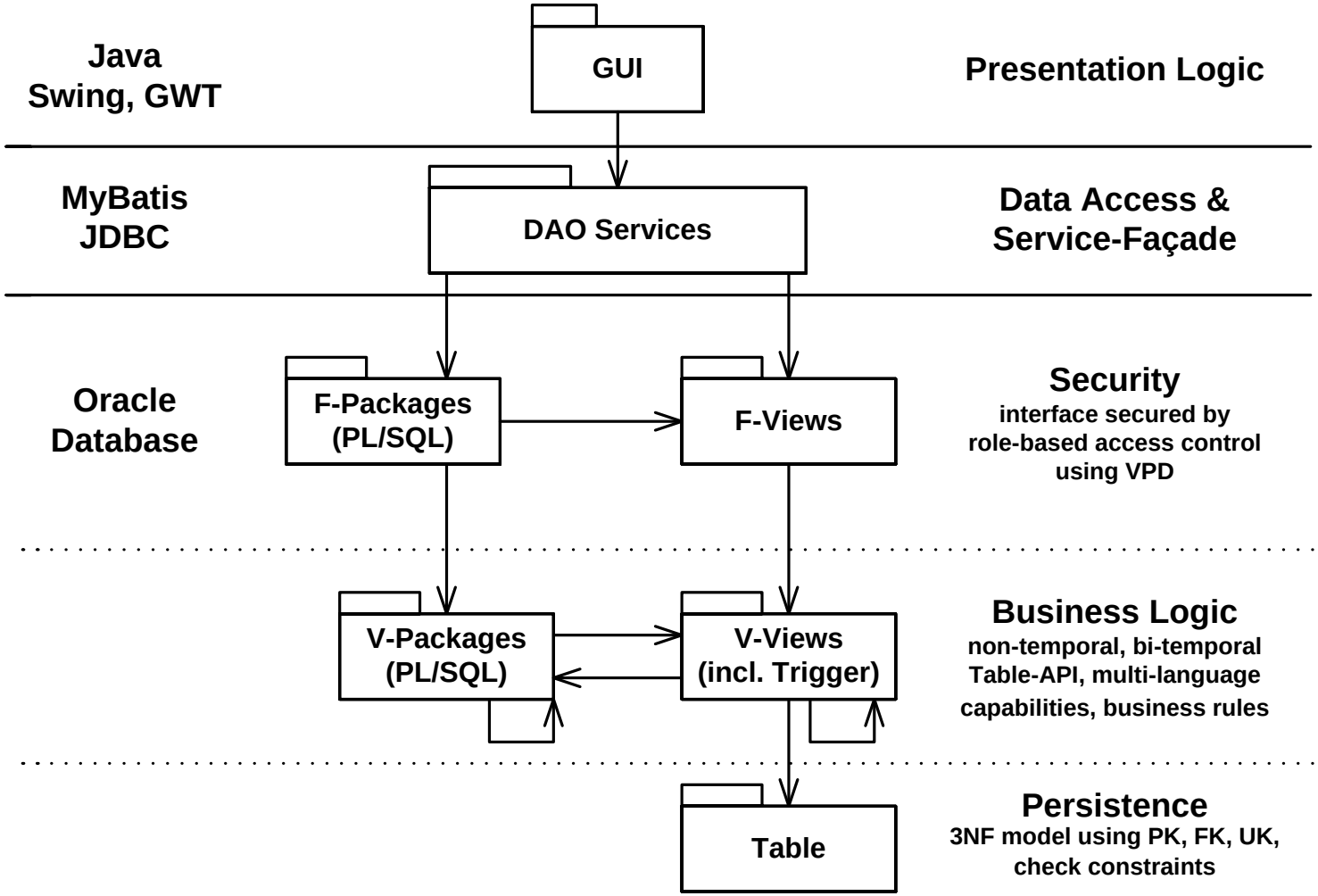
# Architecture



# Some Figures

- Initial release of "IT21" in 2001 to support all business processes
- Extended constantly due to new and revised demands
- Consists of 41 schemas consuming ~ 330 GB (on 22nd September 2013)

| Object Type | Count | Sub-objects | Lines of code | Code in KB |
|---|---|---|---|---|
| FUNCTION | 8 | - | 191 | 8 |
| PACKAGE | 1'405 | 15'223 | 164'348 | 6'797 |
| PACKAGE BODY | 1'391 | 21'209 | 1'068'633 | 41'728 |
| PROCEDURE | 6 | - | 281 | 9 |
| TABLE | 1'625 | - | - | - |
| TRIGGER | 1'203 | - | 63'820 | 3'213 |
| TYPE | 335 | 102 | 3'619 | 141 |
| TYPE BODY | 31 | 102 | 1'167 | 45 |
| VIEW | 4'619 | - | 107'699 | 5'119 |
| **Total** | **10'623** | **21'311** | **1'409'758** | **57'060** |

# Mandate

## Tasks

- Find unused objects
  - Functions
  - Packages
  - Procedures
  - Types
  - Views
- Find unused sub-objects
  - Package procedures
  - Package functions
  - Type methods

## Objectives

- Reduce maintenance base
- Avoid alignment of unused objects
- Simplify overall solution
- Increase development efficiency
- Reduce costs

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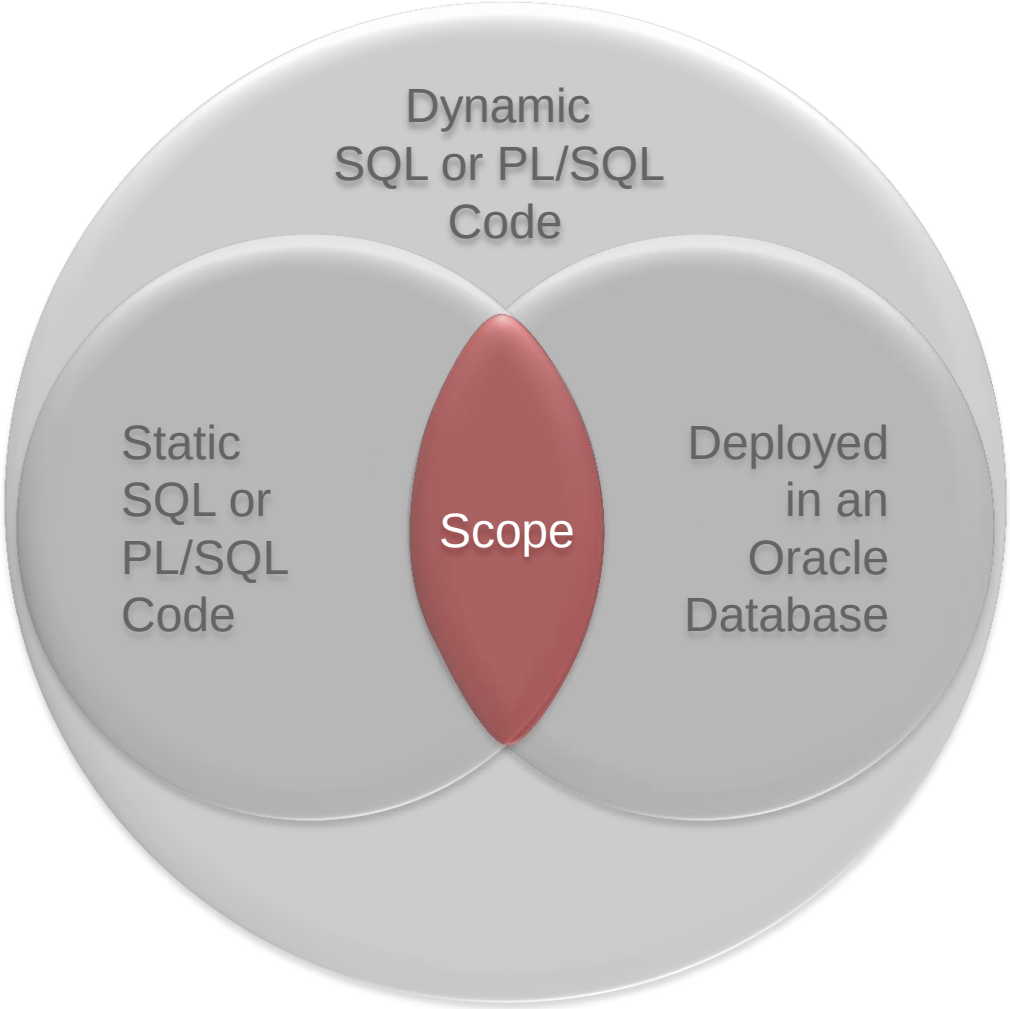
# Scope of Database Dependency Analysis



# Query Unreferenced Objects (1)

```
WITH
   -- objects to be checked
   obj AS (
      SELECT /*+no_merge */ owner, object_type, object_name, status
        FROM dba_objects
       WHERE -- only grantable object types
             object_type IN ('FUNCTION', 'PROCEDURE', 'PACKAGE', 'TYPE', 'VIEW')
             -- only appl schemas (exclude Oracle schemas)
         AND owner NOT IN ('ANONYMOUS', 'APEX_PUBLIC_USER', 'CTXSYS', 'DBSNMP', 'DIP',
                           'EXFSYS', 'FLOWS_FILES', 'LBACSYS', 'MDDATA', 'MDSYS',
                           'MGMT_VIEW', 'OLAPSYS', 'ORACLE_OCM', 'ORDDATA',
                           'ORDPLUGINS', 'ORDSYS', 'OUTLN', 'OWBSYS',
                           'SI_INFORMTN_SCHEMA', 'SPATIAL_CSW_ADMIN_USR',
                           'SPATIAL_WFS_ADMIN_USR', 'SYS', 'SYSMAN', 'SYSTEM',
                           'WKPROXY', 'WKSYS', 'WK_TEST', 'WMSYS', 'XDB', 'XS$NULL')
   ), …
```

# Query Unreferenced Objects (2)

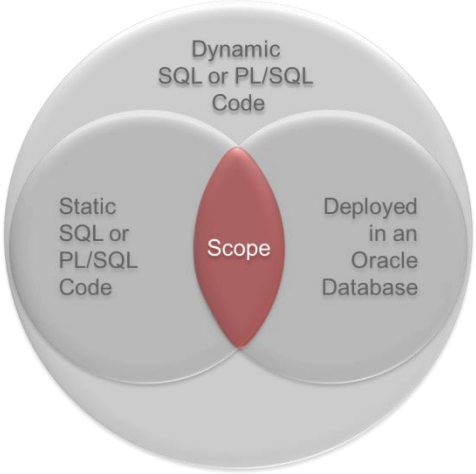
```
…  -- join grants and relevant usages
   dep AS (
      SELECT /*+use_hash (tp) use_hash(r) use_hash (d) */ obj.owner, obj.object_type,
             obj.object_name, obj.status, tp.grantee,
             SUM(CASE WHEN r.type IS NULL THEN 0 -- not referenced
                      WHEN r.type = 'SYNONYM' AND d.type IS NULL THEN 0 -- by syn. only
                      WHEN r.owner = obj.owner AND r.type = 'PACKAGE BODY' AND
                           obj.object_type = 'PACKAGE' AND r.name = obj.object_name THEN
                        0 -- referenced by own package body only
                      ELSE 1
                  END) AS ref_count
        FROM obj
        LEFT JOIN dba_tab_privs tp -- privileges of the object
          ON tp.owner = obj.owner
             AND tp.table_name = obj.object_name
        LEFT JOIN dba_dependencies r -- dependencies of the object
          ON r.referenced_name = obj.object_name
             AND r.referenced_owner = obj.owner
             AND r.referenced_type = obj.object_type
        LEFT JOIN dba_dependencies d -- relevant for synonym dependencies only
          ON d.referenced_name = r.name
             AND d.referenced_owner = r.owner
             AND d.referenced_type = r.type
       GROUP BY obj.owner, obj.object_type, obj.object_name, obj.status, tp.grantee
   ), …
```

# Query Unreferenced Objects (3)

```
…  -- build grantee_list
   glist AS (
      SELECT owner,
             object_type,
             object_name,
             status,
             SUM(ref_count) AS ref_count,
             listagg(grantee, ',') within GROUP(ORDER BY grantee) AS grantee_list
        FROM dep
       GROUP BY owner, object_type, object_name, status
   )
-- main
SELECT owner, object_type, object_name, status, grantee_list
  FROM glist
 WHERE ref_count = 0
 ORDER BY owner, object_type, object_name;
```

```
OWNER      OBJECT_TYP OBJECT_NAME                    STATUS GRANTEE_LIST
---------- ---------- ------------------------------ ------ --------------------
AC_READ    VIEW       MITARBEITER_STAMMDATEN_V       VALID
AENV       FUNCTION   APPL_PARAMETER_STRING_EVALUATE VALID
…
ALOG       VIEW       APPL_LOG_F                     VALID  BASISROLLE,GRUNDDATEN
…
2419 rows selected.
```

# False Positives




- Usage outside of the database
  - Java GUI using generated DAO
  - Java Services using plain JDBC
  - Excel ODBC queries optionally through VBA
  - Legacy Oracle Forms/Reports
  - Scripts (Installation, Test, Configuration Management, Operation)
- Dynamic SQL & PL/SQL within the database
  - Job scheduler
  - VPD policies
  - String fragments within code (execute immediate, DBMS_SQL)
  - Application tables containing SQL or PL/SQL fragments
- Generated Code
  - Table API (Views, Trigger, PL/SQL Packages)
  - Enumerations/Domains (Views)
  - AQ-Views
- New Code (incomplete, currently in developed for new release)

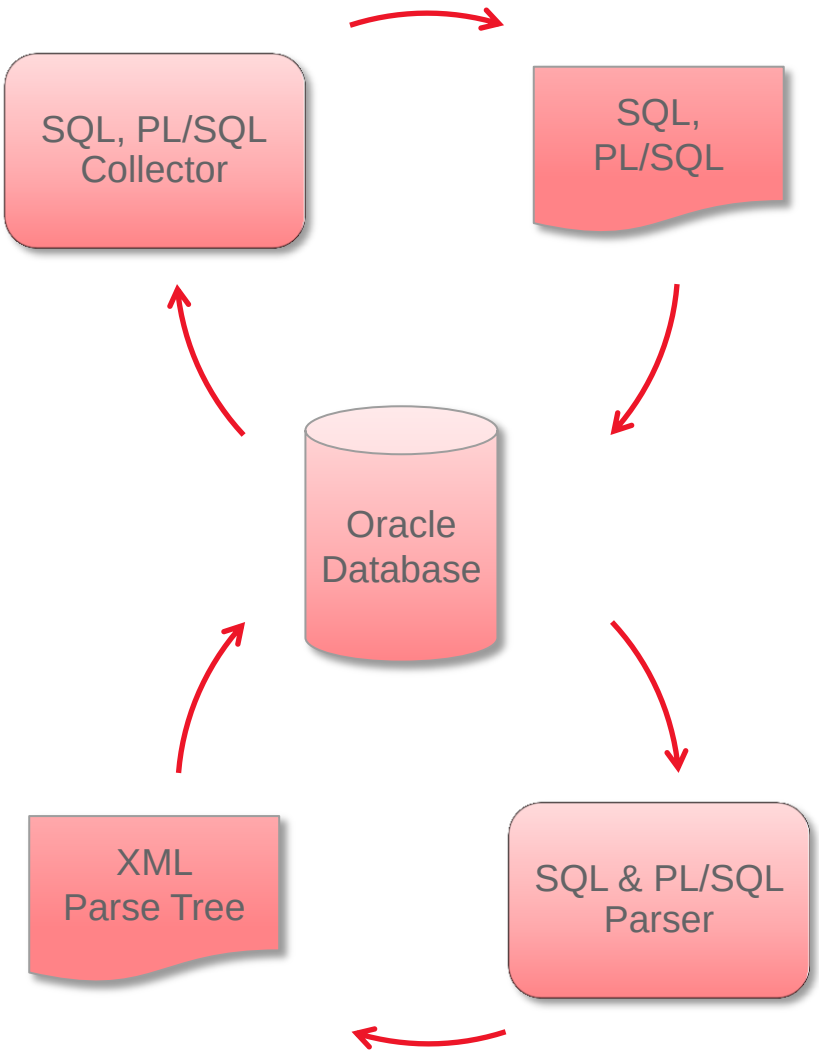
# TVDCA – Trivadis PL/SQL & SQL CodeAnalyzer

- Command line utility to parse PL/SQL and SQL source code within an Oracle database and store the resulting XML parse-trees in dedicated relational tables – as an extension to the Oracle Data Dictionary – for further analysis
- Analysis is supported for static and dynamic code
- Free download from http://www.salvis.com/blog/

# Extend the Oracle Data Dictionary with Captured SQL

```
SQL> desc tvd_captured_sql_t

Name            Type
-------------   -----------------
CAP_ID          NUMBER
CAP_SOURCE      CLOB
SQL_ID          VARCHAR2(13)
USER_NAME       VARCHAR2(30)
SCHEMA_NAME     VARCHAR2(30)
MODULE          VARCHAR2(64)
ACTION          VARCHAR2(64)
LAST_LOAD_TIME  DATE
…
PARSE_TREE      XMLTYPE
```



# Related TVDCA Views

| View name | Shows usage of | Scope | Important columns |
|---|---|---|---|
| tvd_sql_usage_v | Tables, views | Select, insert, update, delete and merge statements in captured SQL | table_owner, table_name |
| tvd_sql_paren_ident_v | Parenthesis expressions | All identifiers in captured SQL, PL/SQL | name (e.g function or type), context (e.g. package or schema) |
| tvd_sql_dot_ident_v | Dot expressions | All identifiers in captured SQL, PL/SQL | left_value, right_value |

# False Negatives

- Ambiguous naming
  - Different object types with same name
  - Same object names used in different schemas
- Examples
  - View ABGRENZUNGSBUCHUNGEN_V exists in schema FM, VK
  - Package GP_UTIL_PA exists in schema GP, VK

```
SELECT object_name,
       COUNT(DISTINCT owner) AS count_owner,
       COUNT(DISTINCT object_type)
  FROM dba_objects
 WHERE object_type IN ('FUNCTION', 'PROCEDURE', 'PACKAGE', 'TYPE', 'VIEW')
       AND owner NOT IN ('ZX', 'APCDWH')
 GROUP BY object_name
HAVING COUNT(DISTINCT owner) > 1 OR COUNT(DISTINCT object_type) > 1;
```

# Automate Most – But Not All – 100% is not Feasible

Captured

- Java DAO usage
- Job network (PL/SQL)
- Excel ODBC access
- Quality queries
- Workflow calls (PL/SQL)
- Search utility Interface (Views)
- Managed VPD predicates

Excluded

- Dynamic Code within database
- Java Services using non-standard access paths (e.g. plain JDBC)
- Legacy Oracle Forms/Reports
- Scripts

# Identified Unused Objects

| What | Quantity |
|---|---|
| Unreferenced objects | 2'419 |
| ./. Generated F-Views | 1'468 |
| ./. Packages with grants | 56 |
| ./. Generated domain packages (enumerations) | 215 |
| ./. Generated table API (temporal views) | 223 |
| ./. Objects in irrelevant schemas (generated, operations, samples) | 44 |
| ./. Manually managed false positives (apg_ignore_objects_v) | 54 |
| ./. Exclusive dynamic usage identified through TVDCA | 69 |
| **= Total** | **290** |

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# Oracle Data Dictionary Dependency Granularity

DBA_DEPENDENCIES

- Object (Table, View, Package, Package Body, …)
- Internally there's more, but not exposed,
  see Rob van Wijk's post about DBA_DEPENDENCY_COLUMNS
  http://rwijk.blogspot.com/2008/10/dbadependencycolumns.html

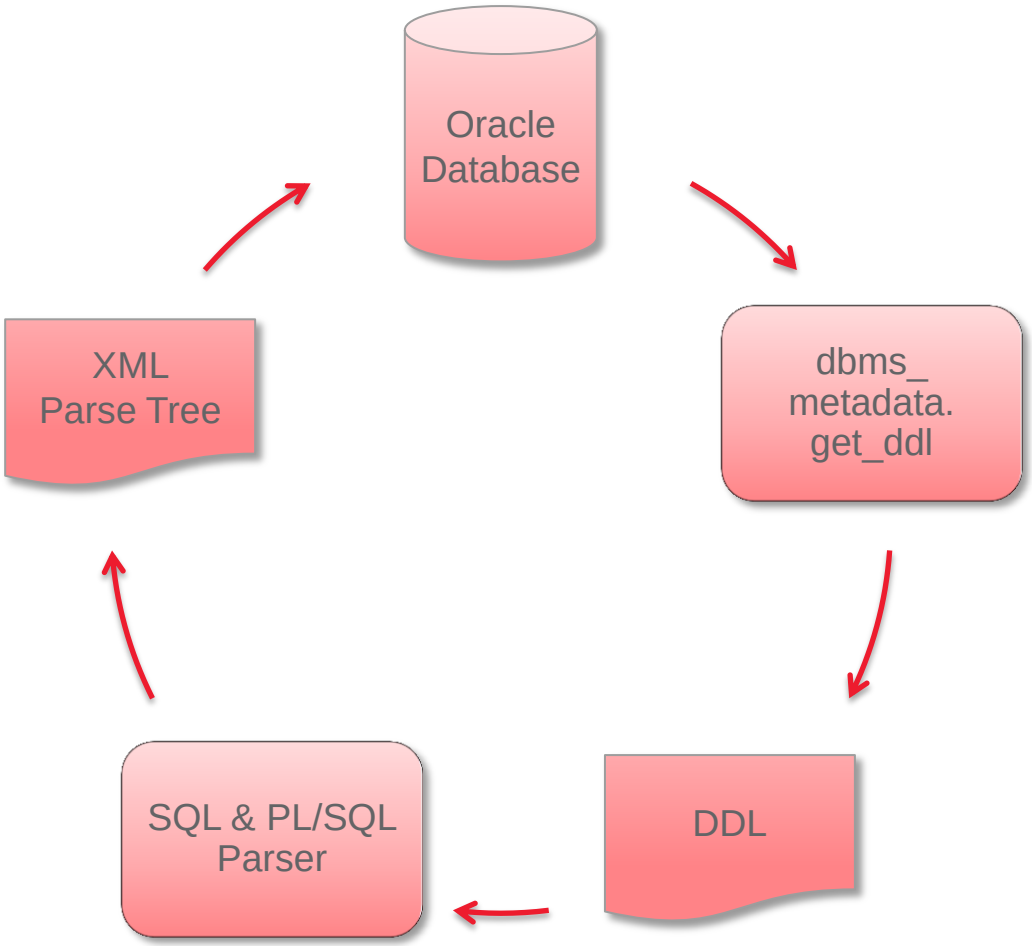
DBA_IDENTIFIERS

- PL/SQL identifier (variable, function, …)
  with usage (call, reference, …)
- Context as hierarchy of usage_id (usage_context_id = parent)
- But no support for SQL (Select, Insert, Update, Delete, Merge)

# Extend the Oracle Data Dictionary with Parsed Objects

```
SQL> desc tvd_parsed_objects_t

Name            Type
-------------- ------------------
OBJECT_ID       NUMBER
OWNER           VARCHAR2(30)
OBJECT_NAME     VARCHAR2(128)
OBJECT_TYPE     VARCHAR2(30)
LAST_DDL_TIME   DATE
DDL_SOURCE      CLOB
PARSE_TREE      XMLTYPE
```



# Related TVDCA Views

| View name | Shows usage of | Scope | Important columns |
|---|---|---|---|
| tvd_sql_paren_ident_v | Parenthesis expressions | All identifiers in captured SQL, PL/SQL | name (e.g function or type), context (e.g. package or schema) |
| tvd_sql_dot_ident_v | Dot expressions | All identifiers in captured SQL, PL/SQL | left_value, right_value |
| tvd_object_paren_ident_v | Parenthesis expressions | All identifiers in SQL, PL/SQL in stored objects | name (e.g function or type), context (e.g. package or schema) |
| tvd_object_dot_ident_v | Dot expressions | All identifiers in SQL, PL/SQL in stored objects | left_value, right_value |
| tvd_object_proc_call_v | Procedures | All PL/SQL proc./func. calls in stored objects | called_proc_name |
| tvd_object_string_usage_v | Strings | All strings in stored objects | string_value (CLOB) |

# False Negatives

- Overloading

```
PROCEDURE schreiben(p_text IN VARCHAR2);
PROCEDURE schreiben(p_log_typ IN log_type, p_text IN VARCHAR2);
```

```
FUNCTION to_integer (in_boolean IN BOOLEAN) RETURN PLS_INTEGER;
FUNCTION to_integer (in_varchar2 IN VARCHAR2) RETURN PLS_INTEGER;
```

- Ambiguous Naming
  - Different object types with same name
  - Same object names used in different contexts (e.g. same method name across multiple types)

# Query, Result and Next Steps

- Query Approach
  - Materialize TVDCA views
  - Use DBA_PROCEDURES as starting point (exclude irrelevant schemas and objects)
  - LEFT Join with TVDCA views and other references (e.g. DBA_POLICIES)
  - If non of the left joined data is found, the procedure/function is unused
  - Aggregate result on package procedure/function level
- Result
  - ~ 1'200 unused package procedures/functions found
  - False positives based on "some" dynamic SQL expected
  - Deletion is in progress by responsible teams (if no usage is found in suspected areas by the topic specialists)
  - Refine query criteria based on patterns identified by manual checks

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# Core Messages

- Consider usage outside of the database when looking for unused database objects
- Establish an "ETL" process to store all information in a single repository to be combined with the Oracle Data Dictionary
- Use own and 3rd party parsers to increase accuracy of results
- Capturing runtime SQL is in most cases not feasible
- Make it a part of your development process – results are becoming better with ever iteration

# THANK YOU.

Trivadis AG

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