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How to Migrate a Plan using SQL Plan Management (SPM)

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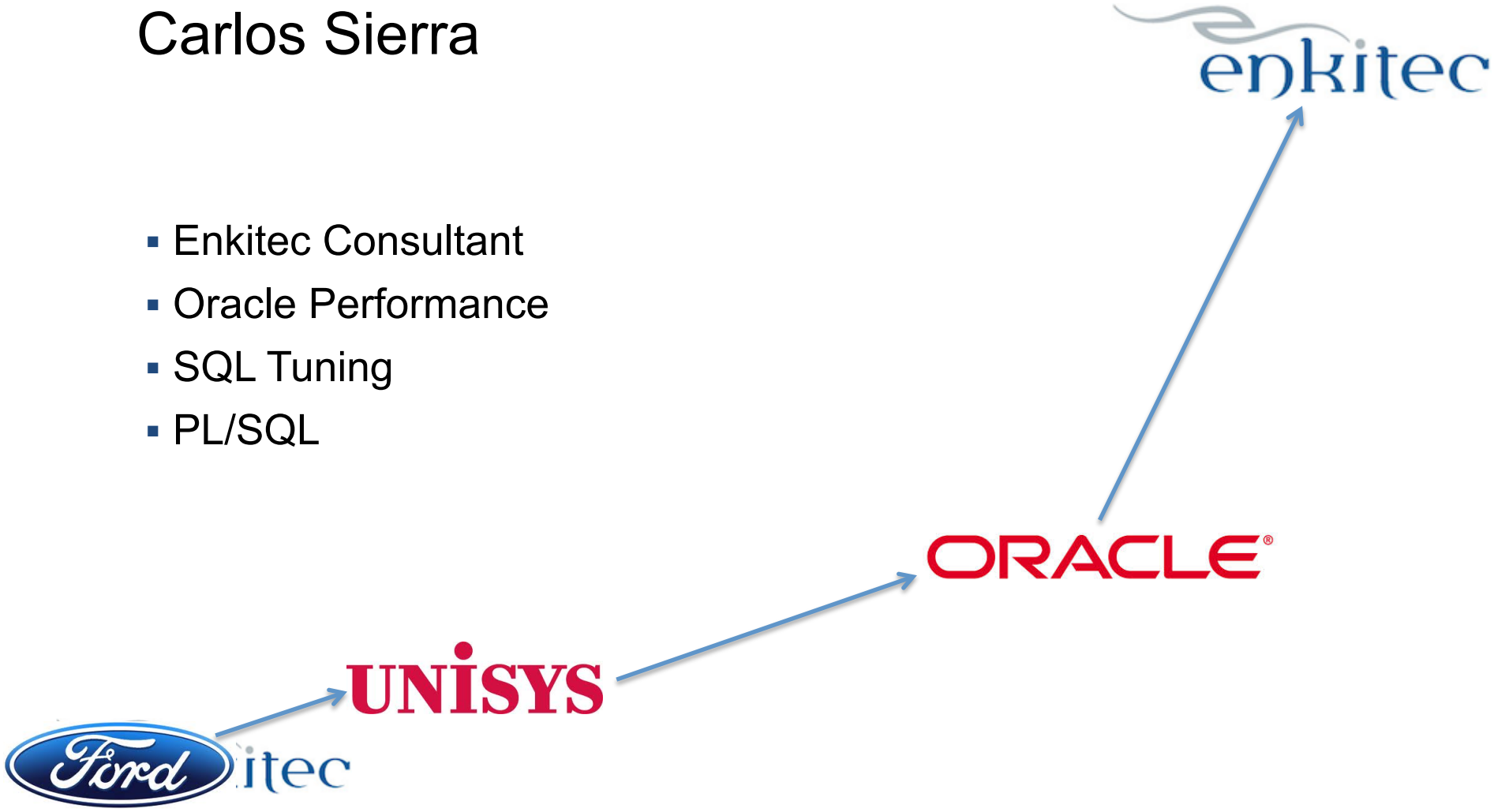

How to Migrate a Plan using SQL Plan Management (SPM)

- SPM Mechanics
- Plan Migration Methods
- Scripts
- Demo

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SPM Mechanics

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SPM Mechanics

- Concepts
- Control and Status Flags
- Plan Selection
- Capturing and Loading Plans
- Plan Evolution

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Concepts

Plan as a function of CBO stats, binds and CBO environment

- Plan Flexibility
  - Cardinality Feedback (CFB)
  - Adaptive Cursor Sharing (ACS)
  - SQL Tuning Advisor (STA) Profiles
- Plan Stability
  - CBO Hints
  - Stored Outlines
  - SQL Plan Management

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SQL Plan Management (SPM)

Goals

- One or more Optimal Plans per SQL
- Plan Stability
  - Only known and accepted Plans can be executed
- Plan Flexibility
  - Capture new Plans and evaluate their performance “off-line”
- Persistent Plans

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SQL Plan Management (SPM)

Terminology

- SQL Management Base (SMB)
- SQL Plan Baseline (SPB)
- Plan
  - History
  - Selection
  - Capture
  - Loading
  - Evolution

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SPM Control and Status Flags

See dba_sql_plan_baselines

- Control
  - Enabled
  - Accepted
  - Fixed
- Status
  - Reproduced
  - Autopurge
  - Rejected (verified and not accepted)

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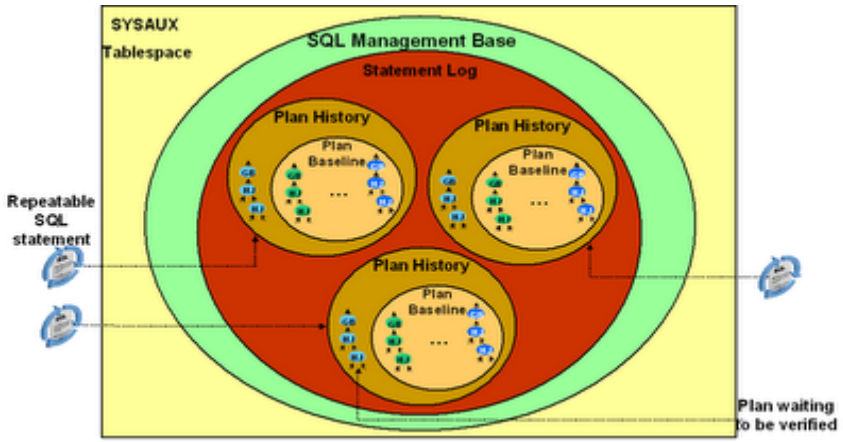
SQL Plan Baseline versus Plan History

SPB is a subset of Plan History

- SQL Plan Baseline (SPB)
  - Enabled
  - Accepted
  - Reproduced
  - Subset of dba_sql_plan_baselines
- SQL Plan History
  - Superset which includes SPB
  - Full content of dba_sql_plan_baselines



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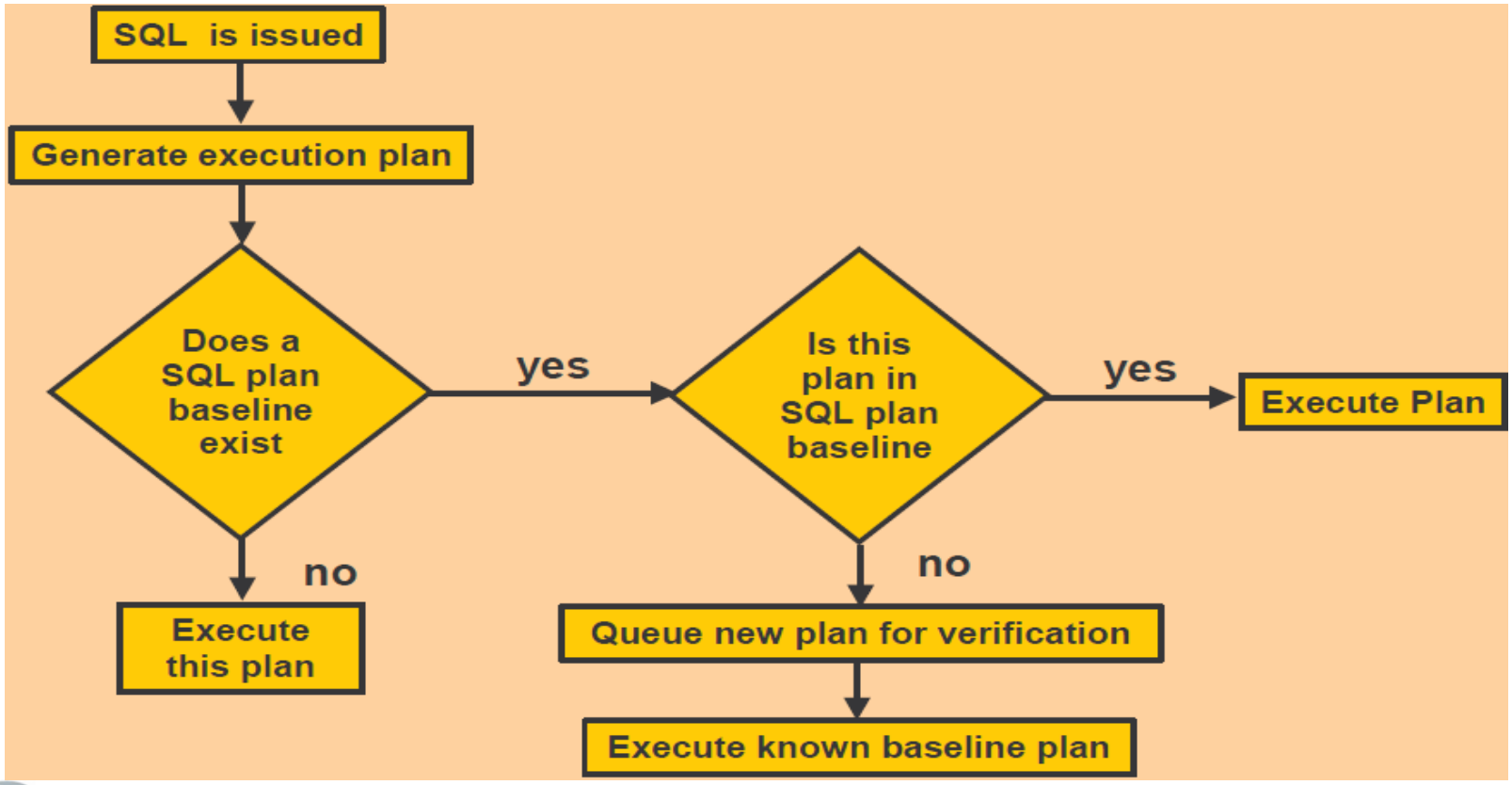
Plan Selection



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Plan Selection

During a hard parse while SPM is active and SPB exists

- CBO computes New Optimal Plan (NOP) before looking at SPM
- If NOP exists in SPB then execute NOP
- If NOP does not exist in SPB then store NOP in PH and
  - If there is at least one “fixed” plan in SPB then
    - Re-cost all “fixed” plans in SPB and select plan with lowest cost
  - If no plans were “fixed” in SPB then
    - Re-cost all plans in SPB and select plan with lowest cost

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Capturing Plans into SPM

Out of Cursor

- To capture 1st Plan into SQL Plan Baseline (SPB)
  - Set OPTIMIZER_CAPTURE_SQL_PLAN_BASELINES to TRUE
  - Execute SQL 2 times
- To capture more Plans into Plan History (PH)
  - Set OPTIMIZER_USE_SQL_PLAN_BASELINES to TRUE (default)
  - OPTIMIZER_CAPTURE_SQL_PLAN_BASELINES does not matter
  - Execute SQL with different binds values
  - ACS may generate more plans into PH

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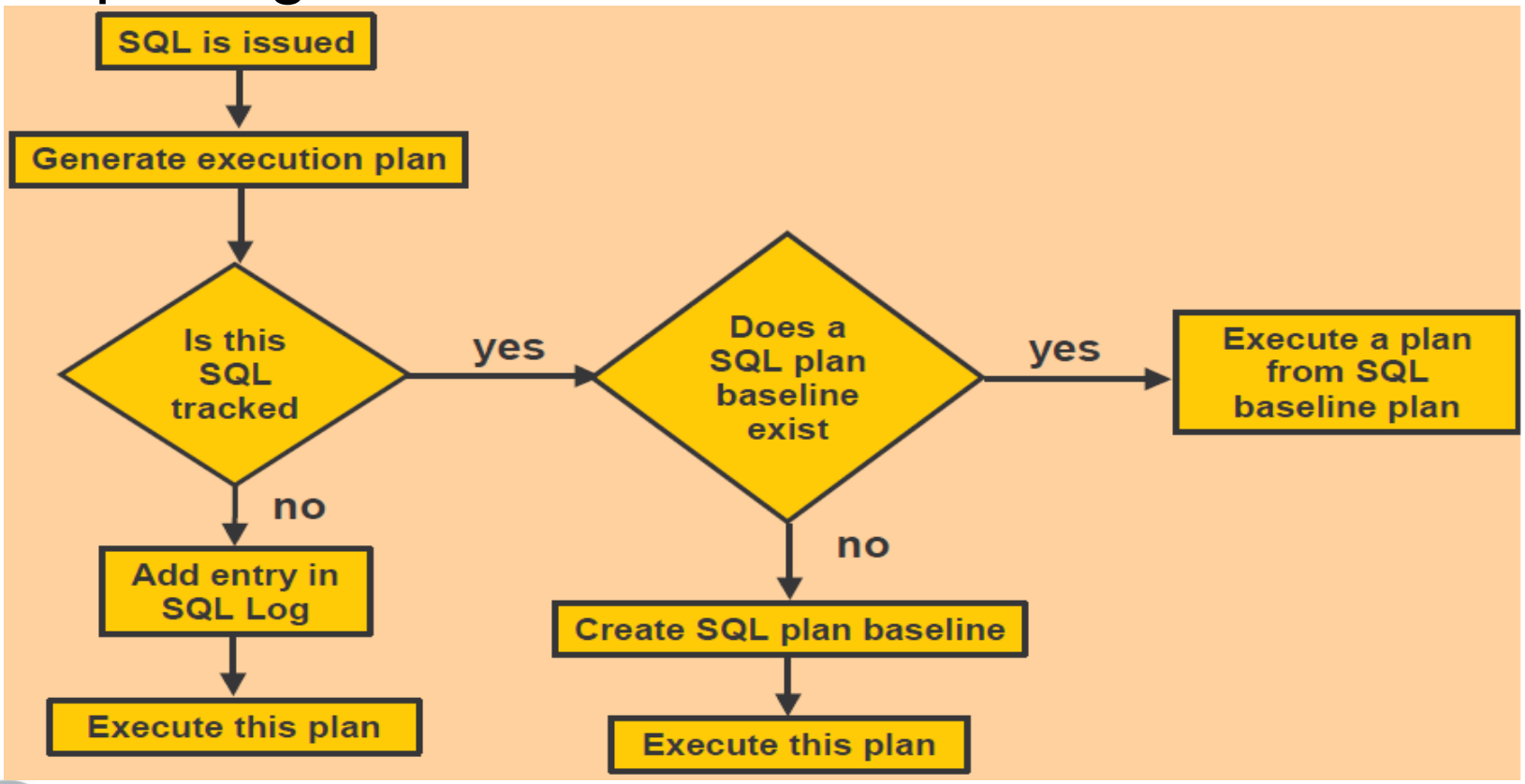
Capturing Plans into SPM



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Loading Plans into SPM

Sources

- Cursor Cache (CUR)
  - DBMS_SPM.LOAD_PLANS_FROM_CURSOR_CACHE
- SQL Tuning Set (STS)
  - DBMS_SPM.LOAD_PLANS_FROM_SQLSET
- Stored Outlines (SO)
  - DBMS_SPM.MIGRATE_STORED_OUTLINE
- Another System (Migration)
  - DBMS_SPM.(UN)PACK_STGTAB_BASELINE

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Loading Plans into a SQL Tuning Set

Sources

- Cursor Cache (CUR)
  - DBMS_SQLTUNE.SELECT_CURSOR_CACHE
- Workload Repository (AWR)
  - DBMS_SQLTUNE.SELECT_WORKLOAD_REPOSITORY
- SQL Performance Analyzer (SPA)
  - DBMS_SQLTUNE.SELECT_SQLPA_TASK
- SQL Trace (TRC)
  - DBMS_SQLTUNE.SELECT_SQL_TRACE
- Another System
  - DBMS_SQLTUNE.(UN)PACK_STGTAB_SQLSET

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Oracle Pack Licenses

Oracle Tuning Pack and Oracle Diagnostics Pack

- DBMS_SPM
  - No Pack License
- DBMS_SQLTUNE
  - Requires Oracle Tuning Pack
- Automatic Workload Repository (AWR)
  - Requires Oracle Diagnostics Pack
- Oracle Tuning Pack requires Oracle Diagnostics Pack

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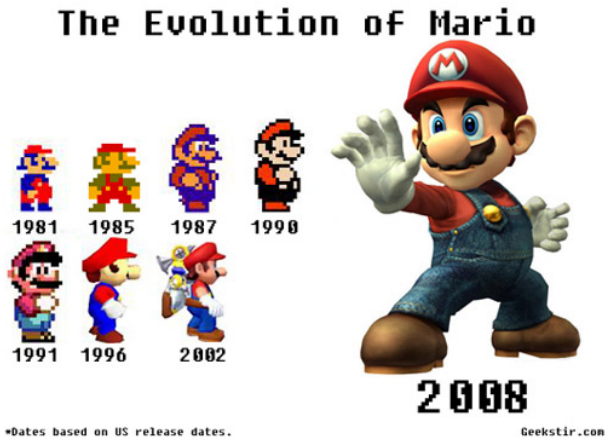
Plan Evolution

Accepting a Plan

- One API
  - DBMS_SPM.EVOLVE_SQL_PLAN_BASELINE
- Parameters
  - SQL Handle
  - Plan Name
  - Verify Control Flag
  - Commit Control Flag
  - Time Limit



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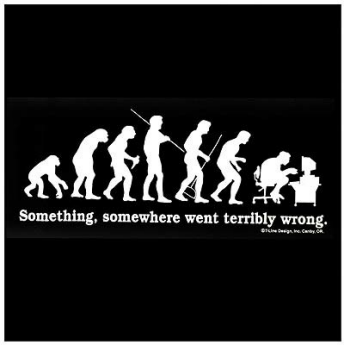
Evolving a Plan

Possible Actions (all generate a report)

- Evaluate performance of new plan without affecting SPB
  - Verify and not commit
- Evaluate performance of new plan and promote it into SPB
  - Verify and commit
- Skip performance evaluation and promote plan into SPB
  - No verify and commit



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Plan Migration Methods

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Plan Migration Methods

- Without using Oracle Diagnostics or Tuning Packs
- Using Oracle Tuning Pack
  - Creating a SPB on SOURCE
  - Without creating a SPB on SOURCE

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Plan Migration using SQL Plan Management

Without using Oracle Diagnostics or Tuning Packs

1. Capture or Load SPB in SOURCE from CUR or SO
2. Pack SPB in SOURCE into staging table
3. Export SPB staging table in SOURCE
4. Import SPB staging table into TARGET
5. Unpack (restore) SPB from staging table in TARGET

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Plan Migration using SQL Plan Management

Using Oracle Tuning Pack (sub-option 1)

1. Create STS in SOURCE from AWR (or CUR or SPA or TRC)
2. Create SPB from STS in SOURCE
3. Pack SPB in SOURCE into staging table
4. Export SPB staging table in SOURCE
5. Import SPB staging table into TARGET
6. Unpack (restore) SPB from staging table in TARGET

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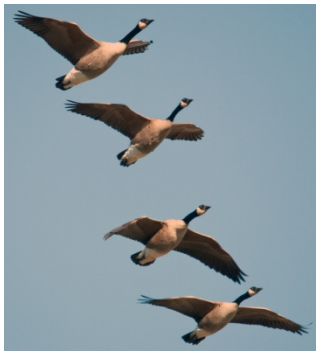
Plan Migration using SQL Plan Management

Using Oracle Tuning Pack (sub-option 2)

1. Create STS in SOURCE from AWR (or CUR or SPA or TRC)
2. Pack STS in SOURCE into staging table
3. Export STS staging table in SOURCE
4. Import STS staging table into TARGET
5. Unpack (restore) STS from staging table in TARGET
6. Create SPB from STS in TARGET



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Scripts

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Scripts

- Create
- Display
- Migration
- Maintenance
- Drop

Create Scripts

- Create STS from CUR
- Create STS from AWR
- Create SPB from CUR
- Create SPB from AWR
- Create SPB from STS

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Display Scripts

- Display CUR
- Display AWR
- Display STS
- Display SPB

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Migration Scripts

- Pack and Exp SPB
- Imp and Unpack SPB
- Pack and Exp STS
- Imp and Unpack STS

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Maintenance Scripts

- Evolve SPB
- Alter SPB

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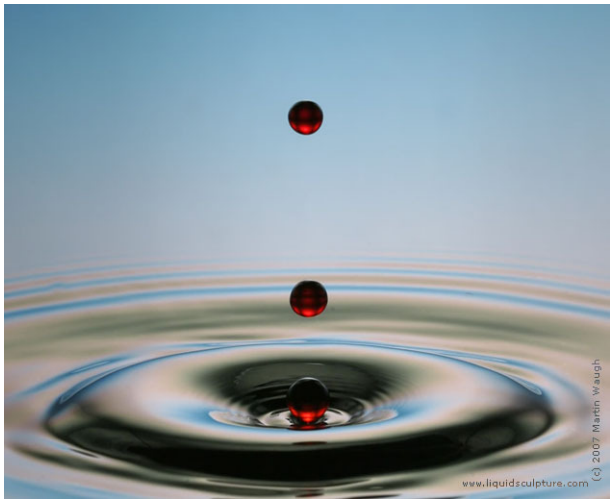
Drop Scripts

- Drop CUR
- Drop STS
- Drop SPB



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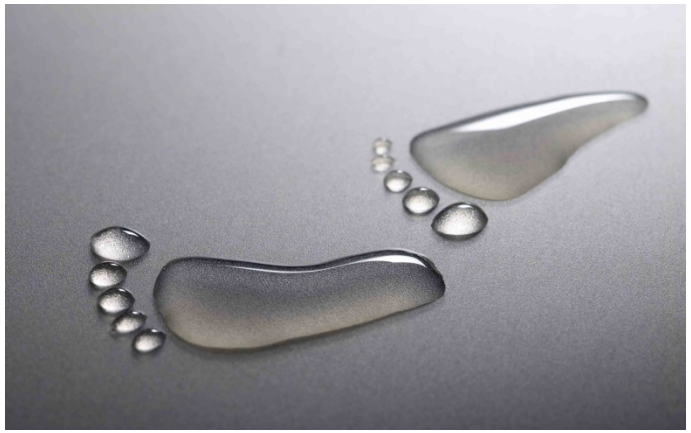
SPM Migration Steps

Creating a SPB in SOURCE

1. Create a SPB in SOURCE
   - Create SPB from CUR; or
   - Create SPB from AWR (requires Oracle Tuning Pack)
2. Pack and Exp SPB from SOURCE
3. Imp and Unpack SPB into TARGET

- Pros: Simple
- Cons: Requires a SPB on SOURCE



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SPM Migration Steps

Without creating a SPB in SOURCE (requires Oracle Tuning Pack)

1. Create a STS in SOURCE
   - Create STS from CUR; or
   - Create STS from AWR
2. Pack and Exp STS from SOURCE
3. Imp and Unpack STS into TARGET
4. Create SPB from STS in TARGET

- Pros: No SPB is required in SOURCE
- Cons: Requires an Oracle Tuning Pack license

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SPM Migration Steps

Using coe_load_sql_baseline.sql (requires Oracle Tuning Pack)

1. Execute coe_load_sql_baseline.sql in SOURCE
   - Enter original SQL_ID
   - Enter modified SQL_ID and its Plan Hash Value
2. Follow installation steps from log into TARGET

- Pros: Allows you to create SPB with plan from modified SQL (opt)
- Cons: Requires an Oracle Tuning Pack license

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Demo

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References and Contact Info

Oracle Optimizer Blog

- https://blogs.oracle.com/optimizer/
  - Insight into the workings of the Optimizer

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