LSA++ (Layered Scalable Architecture) for SAP NetWeaver BW on SAP HANA

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Agenda

LSA++ - the holistic Picture for BI on structured Data
  • LSA++ Focus on Flexibility, Agility, Virtualization, Openness and Consistency

LSA++ flexible consistent EDW Core
  • Streamlined EDW & Architected Data Marts

LSA++ Open Operational Data Store Layer
  • Joining Operational BI & EDW

LSA++ Virtual Data Mart Layer

Summary
LSA++ - The holistic Picture for BI on structured Data
**BW EDW LSA Grid**

Consistent EDW Architecture – Consistent BI & Reporting

- **BW EDW Standard LSA Layers**
  - **Virtualization Layer**
  - **Reporting Layer / Architected Data Marts**
  - **Business Transformation Layer**
  - **Data Propagation Layer**
  - **Quality & Harmonisation Layer**
  - **Corporate Memory**
  - **Data Acquisition Layer**

- **BW EDW LSA Data Domains** *(standard Partitioning)*
  - **AMS**
  - **US**
  - **EMEA**
  - **UK**
  - **Germany**
  - **APJ**

**Layer and naming qualifier**

**Naming** *(e.g. DSO)*

- **Layer**: byte 1
- **Content Area**: byte 2 to 5
- **Sequence number**: byte 6
- **Domain**: byte 7
- **Sub-Partition**: byte 8

Example:

```
1  P  Propagation Layer InfoProvider
2-5 LSOL Area filled from Sales Order Schedule Line DataSource
6  0  1st InfoProvider with respect to area in this layer
7  B  Domain EMEA
8  0  No further logical/semantic partitioning (e.g. by time)
```
LSA standardized template-based Implementation –
Templates as Link between LSA Blueprint & Implementation

Customer
EDW LSA Blueprint:
Standards & Guidelines

Templates:
Data Flow Templates

SPO Partition Templates

BW Projects using
Templates:
Consistent Implementation
adopting
LSA Blueprint
Standards & Guidelines
EDW, Data Marts and Model Richness
Consistent BI on Consistent EDW

(Architected) Data Marts
built on EDW Model

Data Marts
built on Source Models

Business View
Data Mart Model

Data Mart transform

EDW data model

EDW transform

source data models

Business View
Data Mart model

Data Mart transform

source data models
BW Layered Scalable Architecture - Value & Positioning
consistent, high Availability EDW for standardized BI

BW EDW with LSA is the accepted approach (not just for large companies) guaranteeing standardized BI & Reporting on all organizational levels (local, regional, global) on the same consistent, common data foundation (single version of truth)

BW EDW with LSA stands for:
- High availability - 24x7
- Operational robustness
- Organizational independency
- Scalability
- Maintainability e.a.

The LSA is the corporate framework for BW to manage reliably the entire data & meta data life cycle:
- Data delivery (extraction, RDA)
- Data modeling (assign InfoObjects)
- Data staging
- Authorizations
- Solution delivery (transports)
An BW EDW with LSA is perceived as highly valuable but

- costly: building it, moving steadily data to and within the EDW
- not flexible enough: EDW/LSA standards, central development, overall responsiveness to business needs (operational & agile BI)

- Number of persistent InfoProvider
- overall missing flexibility, agility

- Setting up BW EDW - time to ROI
  - The BW data model (InfoObjects) must be defined
  - The customer LSA must be defined

- No direct business value of Acquisition Layer
- EDW model (InfoObjects) assignment
- Staging of data
- Low Adoption of Near Real Time reporting
- Costs of Corporate Memory
LSA++ for BW on HANA – A Holistic Framework
LSA++ Principal Layers & BI Value Areas

Virtualization Layer

Virtual Data Mart Layer

EDW context data

Consistent EDW Core

Streamlined consistent EDW Core for flexibility & lower TCO/D
• Virtual Data Marts
•Queryable EDW Layers
• InfoProvider modeling

Standardized template-based BI on LSA consistent EDW Core
• Transparent (Layer)
• Scalable (Domains)
• Model-driven (EDW data model)

Streamlined consistent EDW Core for flexibility & lower TCO/TCD
• HANA-Optimized InfoProvider
• Direct data provisioning
• Real Time Master Data
LSA++ for BW on HANA – A Holistic Framework
LSA++ Principal Layers & BI Value Areas

Virtualization
Virtual Data Mart Layer

EDW context data
Flexible Consistent EDW Core

Source context data
Open ODS Layer (Open Operational Data Store)

Operational BI
Open ODS Layer on field-level data (source models inherited)
• Openness, Scalable BW Services
• Immediate querying

Operational BI
& Virtual Data Marts
• Wrapping & Combining
• Scalable integration with EDW
LSA++ for BW on HANA – A Holistic Framework
LSA++ Principal Layers & BI Value Areas

LSA++ Principal Layers & BI Value Areas

- Flexible Consistent EDW Core
- Virtualization
  - Virtual Data Mart Layer
- Agile BI
  - Virtual Agile Data Marts combining volatile ad-hoc data with EDW Core & Open ODS data
  - Virtual Agile Data Marts wrapping of ad hoc data (Workspaces)

Source context data
- Open ODS Layer (Open Operational Data Store)

Agile context data
- Agile Data Marts

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LSA++ Holistic Framework
LSA++ Principal Persistent Layer

Open Operational Data Store
Operational Extension
BW / Externally managed

Architected Data Marts
Flexible Consistent EDW Core
EDW Layers

Central Agile Extension
Agile Data Mart Layer

Departmental Agile Extension
BW Workspace (Layer)

Principal Layer
LSA++
Different BI flavours request for different services. LSA++ takes this into consideration structuring data by purpose/ context with respect to BI requirements - this results in the principal layers:

**Flexible Consistent EDW Core:** EDW context data –
- Standardized template-based BI and Reporting on harmonized, consistent data

**Operational Extension of the Core:** Operational/ source context data –
- Operational / real time BI on source-level data

**Agile Extension of the Core:** Agile, ad hoc context data –
- Agile BI on all kind of data – single usage

LSA++ purifies the EDW Core addressing services for operational & agile purpose data - free the EDW core from cholesterol -
This by itself increases overall flexibility and manageability
LSA++ Holistic Framework
Characteristics of Principal Layers & BI Solutions

BI solutions based on different LSA++ principal Layers have decisive differences with respect to e.g.

- Data model
- Solution time-to-market
- Data Processing
- Ownership

Data model:

- Consistency
- Stability & Robustness
- BI query result stability
- Revision capability.....

Deployment:
LSA++ Holistic Framework for BW on HANA
flexible consistent Data Framework virtually Wrapped

BI on Streamlined EDW - Operational BI – Agile BI – Virtualization - Open BW Services

- EPM, BO BI, Apps
- BW Queries
- BW Virtual Data Mart Layer
  - Architected Data Mart Layer
  - Business Transformations
  - EDW Propagation Layer
  - EDW Transformation Layer
- Open Operational Data Store Layer
  - Externally managed
  - BW managed

Agile BI - central/departmental

LSA++ for BW on HANA

Agile DMs/BW Work space

Corporate Memory

Reference

Central BI - Promote To Production

BW Open Services: Data Model, OLAP, Authorization, Data Aging

EPM, BO BI, Apps

BW Queries

BW Virtual Data Mart Layer

Architected Data Mart Layer

Business Transformations

EDW Propagation Layer

EDW Transformation Layer

Open Operational Data Store Layer

Externally managed

BW managed

Agile BI, Operational BI

BI on Streamlined EDW, Operational BI

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LSA++
flexible consistent EDW Core
Streamlined EDW & Architected Data Marts
LSA++ EDW & Architected Data Marts Value Scenarios
Classic BW EDW Implementation Perspective

EDW & Architected Data Mart layers - **reliable, manageable, consistent**

**Streamlined EDW & Architected Data Marts**

- HANA-Optimized InfoProvider – *increased availability, lower TCO*
- Virtualization of persistent Data Marts (InfoCubes) - *increased availability, lower TCO*
- Queryable EDW layers - *increased availability, lower TCO*
- Virtual Data Marts – *increased flexibility, lower TCO*
- Real Time EDW Master Data – *new solutions, lower TCO*
- New modeling options – *increased flexibility & coverage of business needs*
  - Flexible Master Data Modeling thru virtually joining semi-stable master data
  - Large Master Data Modeling avoiding realignment thru compounding instead of fact-table join
- New inventory modeling

......
LSA++ Layer Structure of Flexible Consistent EDW Core
The LSA Heritage - Reliable, Manageable, Consistent Data

LSA++ inherits the service definitions of LSA EDW Layers that stand for reliability & consistency:

- EDW Transformation Layer (Link between source-model and EDW-model)
- (EDW) Corporate Memory (Persistent )
- (EDW) Propagation Layer (Persistent )
- Business Transformation Layer (Link between EDW-model and Data Mart model)
- Architected Data Mart Layer (Persistent )

These Layers define the consistent Core:

Diagram showing the layers:
- Architected Data Marts
- Business Transformations
- EDW Propagation Layer
- Corporate Memory
- EDW Transformations
EDW Core services are:

1. Transparency & addressability of different quality stages of data
2. Managing different levels of data harmonization within the organization
3. Maintainability thru transparent standards
4. Robustness thru standards
5. Auditability & reproducibility
6. Reusable, Digestible, Comprehensive EDW data mean consistency & flexibility
   - same reusable reliable consistent data foundation for all (Architected) Data Marts - extract once, deploy many
   - reusable meta data foundation (InfoObjects, InfoProvider)
7. Consistent, accurate query results, avoiding errors, miss-interpretations, reducing virtual complexity
8. Query performance - avoiding redundant calculations, transformations, (high cardinality) combinations (joins) thru persistent Architected Data Mart
LSA++ for BW on HANA Value Scenario
Streamlined EDW - Reducing Flexibility Impact of Persistent Provider

LSA++ EDW persistent Provider offer accepted services in

- (EDW) Corporate Memory
- (EDW) Propagation Layer
- Architected Data Mart Layer

But: persistent Provider have a huge influence on overall flexibility and cost

- Flexibility is low & TCO is high if any new requirements result in changing or adding of persistent providers (meta data & data content)
- TCO is high & SLA fulfillment is low if source- or operational- issues lead to changes of persistent providers (rebuild, recover of data content)

LSA++ focus is on Streamlining the Consistent EDW Core by

- reducing number of persistent provider
- optimizing design and implementation of persistent provider
- reducing change impact on persistent provider

⇒ LSA++ Flexible Consistent EDW Core
LSA++ for BW on HANA Value Scenario
Streamlined EDW - EDW Propagation Layer using HANA Optimized DSOs

- Increased availability thru dramatic decrease of load and activation time
- Increased modeling flexibility
- Increased flexibility & value thru comprehensive data content offering of Propagation Layer
- Relaxed volume considerations during design time (Domains/ semantical Partitioning)
LSA++ for BW on HANA Value Scenario
Streamlined EDW - Architected Data Marts using HANA Optimized InfoProvider

LSA++ Architected Data Mart Layer should use HANA Optimized InfoCubes and/or HANA Optimized DSOs (Business Transformation Layer) in case there is a need for persistent Architected Data Mart (s. Virtual Data Marts)

**LSA++ Architected Data Mart Layer using HANA Optimized InfoCubes means**

- Increased flexibility thru dramatic decrease of load time (no dimension tables)
- Increased modeling flexibility
- No multi-dimensional modeling skills needed
- Relaxed volume considerations during design time (→ Domains/ semantical Partitioning)

Flexible, relaxed modeling

Architected Data Marts

Business Transformations

EDW Propagation Layer

EDW Transformations

Corporate Memory
Queries on DSOs (sid-enabled) show similar performance compared to queries on InfoCubes
Streamlined EDW - Virtualization of InfoCubes

Obsolete: InfoCubes as Accelerator on Business Transformation Layer DSOs
Streamlined EDW - Virtualization of InfoCubes
DSOs in Business Transformation Layer as Query Target

- With complex business requirements we often find DSOs in the Business Transformation Layer reducing complexity of transformations and/or synchronizing various data sources
- There is one final DSO in the flow that offers the result of all transformations
- In LSA under RDBMS the result-DSO data are then transferred 1:1 to an InfoCube for query performance reasons
- Such InfoCubes are obsolete

Please observe notes given on obsolete InfoCubes
Streamlined EDW - Virtualization of InfoCubes
Eliminating InfoCubes – Things to Keep in Mind

An InfoCube is only an accelerator for queries on a DSO placed in the data flow before the InfoCube if

- The content of the InfoCube is derived from the DSO by a selection (DTP) and/or a projection on the DSO InfoObjects
- The InfoCube does not contain information that is not contained in the DSO
- No additional consistency checks (referential integrity) are performed loading the InfoCube
- Such InfoCubes can be eliminated easily if a MultiProvider is defined on top of the InfoCubes and queries access the InfoCubes via the MultiProvider (anyhow Best Practice) replacing the InfoCubes by the DSOs
- Before deleting the InfoCubes the query performance on the MultiProvider now working with DSOs should be verified (RSRT)
- Important for working with DSOs under a MultiProvider is that query pruning takes place (like with InfoCubes under a MultiProvider) -> BW 7.30 SP7/8
- The DSOs should be SID-enabled before querying on DSOs!
In publications we can read that the EDW in general is not a query target. The reason for this statement is not that the EDW content is of no value on the contrary – the reason is more that queries running on EDW tables on RDBMS will most likely not come back (no secondary index = full table scan)

With LSA++ and BW on HANA you can run queries on Propagator Layer DSOs (SID-enabled) with similar performance like on InfoCubes
Streamlined EDW – EDW Propagation Layer as Query Target

LSA & BW on RDBMS

LSA++ & BW on HANA
LSA++ for BW on HANA Value Scenario
Streamlined EDW – Virtual Data Mart Layer

SAP HANA propagates working on basic persistent providers doing all combinations (joins) and transformations of data during query execution instead of making the results of combinations and transformations persistent in a provider (staged approach)

The LSA++ home of virtual combinations is the Virtual Data Mart Layer with Composite & MultiProviders – the home of virtual transformations is the BW query layer.
Streamlined EDW - Virtual Data Mart Layer
CompositeProviders – Virtualization or Persistent Join?

Scenario:

- Multiple DataStore Objects loading into a single InfoProvider
- Nowadays the relation between data (“join”) is modeled in BW transformation (routine) and loaded to a DSO or through updating (overwrite) of a target DSO
- UNION Join in MultiProvider doesn’t correspond to reporting requirements
**Streamlined EDW - Virtual Data Mart Layer**

**CompositeProviders**

**JOINs between InfoProvider** – Combine BW InfoProvider using the JOIN operations (inner, left outer, union join)

Transaction **RSLIMOBW**.
Composite Provider Considerations

Things to keep in Mind – Test before replace a persistent BW Provider

- **HANA** is not an OLAP Engine but a database.
- A lot of BW query function results are provided by the BW OLAP engine not by the database.
  - Not all BW OLAP operations have been pushed down to OLAP calculation engine on HANA yet.
  - For a foreseeable time we will have still a separation of query work packages between HANA DB, OLAP calculation engine on HANA and OLAP engine on the BW application server.
- Development is continuously pushing down OLAP engine functionality to HANA what makes it difficult giving a stable recommendations about virtualization of persistent providers.

Roughly speaking: each query that needs the **application server** OLAP engine working on granular data to provide the right result is expensive (correlating to the no of records that have to be transferred to the application server OLAP engine).

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: provided by OLAP Engine
Decision Criteria on Using Composite Provider
Architected Data Marts and BW Virtual Data Mart Layer

Goal: Virtualization of Architectured Data Mart Layer

Granularity / Cardinality
Architected Data Mart vs. EDW Propagation Layer

- low
  - Replace Data Mart
  - Investigate

- high/same
  - Investigate
  - Keep Data Mart

Transformation / Join logic
EDW Propagation Layer to Architectured Data Mart
Without HANA we can hardly avoid merging data of different stability into persistent InfoProvider and InfoObjects – this causes huge impact on the stability of the resulting Architected Data Marts!
LSA++: Avoid merging data of different stability in an Architected Data Mart or InfoObject – Instead use Virtual Data Marts (Composite Provider/ MultiProvider) to combine extensions with the stable Architected Data Marts
**LSA++ for BW on HANA Value Scenario**

- **Flexible InfoProvider Model**

**Composite Provider Joining Core Providers with Local Masterdata**

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**Corporate Master Data**

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**Composite Provider**

- **Germany**
- **US**
LSA++ Open Operational Data Store Layer
Joining Operational BI & EDW
LSA++ Holistic Framework for BW on HANA
Open Operational Data Store Layer - Targets

BI on Streamlined EDW - Operational BI – Agile BI – Virtualization - Open BW Services

Immediate Querying – no staging to EDW

On any data

Incremental integration with EDW

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The **Open Operational Data Store Layer** is the **LSA++ Inbound Layer** and as such the home of field-level data hosting data either delivered *directly to HANA* (externally managed) or delivered under *control of BW* (BW managed).

Core BW Services for Open ODS Layer data are:

- **BW Integration Services**
  - Consume HANA Modeler schemas in BW and vice versa
  - Transfer HANA Modeler managed data into BW managed area and vice versa

- **BW Operational Data Services**
  - Real time replication into BW
  - Immediate querying on any delivered data – no staging into EDW necessary (Operational BI)
  - Data Modeling

- **BW EDW Services**
  - Open ODS Layer as [source for persistent EDW providers](#)
  - Open ODS Layer Provider as [virtual part of the EDW](#) (if feasible from EDW standpoint)
Open Operational Data Store Layer
Persistent Provider Data Models: Inherited Source Models at Field-Level

Data Marts
actively modeled- InfoObjects, fields

EDW Layers Model
EDW actively modeled-
InfoObjects - InfoProvider

Open ODS Layer
Inherited Source Models:
Fields- DataSources, tables

Extractor Models:
Fields -DataSources

Source Data models
Fields-3NF, Tables, Views

Generic Extractors,
Replication: Fields-Source Data Models
Open ODS Layer services for data delivered under control of BW & modeled with BW (BW managed) and for data directly delivered to HANA tables & modeled with the HANA Modeler (externally managed)
Open Operational Data Store Layer
BW Integration Services for Externally and BW Managed Data

- Consume HANA Modeler schemas in BW and vice versa
- Transfer HANA Modeler managed data into BW managed area and vice versa
Open Operational Data Store Layer

BW Operational Data Services – Real time Replication into BW

(SAP) Source

- Replicating DB calls
- Extracting record images

SLT Replication

SAP BW Extractor

HANA Table

Open ODS Layer

Externally managed

BW Inbound

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Open Operational Data Store Layer
BW Operational Data Services – Immediate Querying

- Immediate querying on delivered data (Operational BI) - no staging into EDW Layers required
- Data Modeling on Open ODS Layer field-level Provider
Open ODS Layer Provider as source for persistent EDW providers - consistency management (delta), transfer (staging) and transformation services for EDW
Open ODS Layer Provider as virtual part of the EDW (if feasible from EDW standpoint) - reduced redundancy, increased responsiveness, incremental EDW
LSA++ Open ODS Value Scenarios & BW Services

Holistic picture of

- Externally, HANA Modeler managed data and BW managed data
- Operational BI and EDW based standard BI

BW Integration Services for Open ODS Layer

- Scalable Integration of HANA Models into BW (and vice versa)
  - Modeling, Query & OLAP services, EDW master data, Authorizations for HANA Models

BW Operational Data Services for Open ODS Layer

- Real Time Data Replication into BW
- Extraction or Replication into BW
- New BW Open ODS Layer Provider
  - Immediate querying on loaded data – no staging to EDW

BW EDW Services for Open ODS Layer

- Managing transfer of data to persistent EDW Providers
- Incremental build of EDW (from virtual to staged scenarios)
- Real time master data in EDW
The Need for a holistic Picture on Operational BI
Integration of Source Level/Operational Data?

‘Having data is a waste of time when you can’t agree on an interpretation’

There is a need for a holistic picture on Source Level/Operational Data to avoid uncontrolled redundancy and island-like BI.

Holistic with respect to the operational data itself and with respect to the EDW.
The target of the Open ODS Layer is to provide the services and technology gaining a holistic picture on data for Operational BI

SAP note 1661202: most up to date list of supported scenarios (e.g. BW and Accelerators) that may run on the same HANA instance
LSA++ Open ODS Layer - The Holistic Picture
Get the Best out of both Worlds

BW managed & modeled data

Market
✓ (Enterprise) DataWarehouse
✓ Layered Scalable Architecture (++)
✓ Model-driven, Governance, Security, ...

Usage
✓ >24,000 active installations
✓ > 16,000 customers

Externally managed data - HANA Modeler

Market
✓ Data Mart
✓ Flexibility, Performance
✓ Native, SQL, tables/views

Usage
✓ HPAs, Accelerators (COPA, Pipeline, …)
✓ Customer-build apps & scenarios
✓ BW-HANA Apps (POS DM, DSiM, …)
✓ Data Services bulk loads
LSA++ Open ODS Value Scenarios & BW Services

**Holistic picture of**

- Externally, HANA Modeler managed data and BW managed data
- Operational BI and EDW based standard BI

**BW Integration Services for Open ODS Layer**

- Scalable Integration of HANA Models into BW (and vice versa)
  - Modeling, Query & OLAP services, EDW master data, Authorizations for HANA Models

**BW Operational Data Services for Open ODS Layer**

- **Real Time Data Replication** into BW
  - Extraction or Replication into BW?
- **New BW Open ODS Layer Provider**
  - Immediate querying on loaded data – no staging to EDW

**BW EDW Services for Open ODS Layer**

- Managing transfer of data to persistent EDW Providers
- Incremental build of EDW (from virtual to staged scenarios)
- Real time master data in EDW
**BW Integration Services for**

**HANA Modeler managed Schema/ Data & vice versa**

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**BW Services for HANA Modeler managed schemas & data**

**HANA models in BW**
- **Consume HANA models** – treat them as InfoProvider

**HANA schema data into BW**
- **Transfer data into EDW** *

**BW models in HANA Modeler**
- **Provide InfoProvider views** **

**BW data in HANA Modeler tables**
- **Transfer data** *

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(*SP08)
(**Q4 2012)
BW Integration Services for LSA++ Open ODS Layer
Integration of HANA Schemas – Treat HANA Schema as InfoProvider

- BW Query, OLAP & Authorization Services
  - Composite / MultiProvider
  - BW Virtual/ Transient Provider on HANA Models
- Architected Data Marts
- EDW Layer
- HANA Views
  - Externally Managed
- Open Operational Data Store Layer
  - DTP*
  - SAP BO DS
  - SLT - replication

* DTP with SP8

HANA Modeler
any schema

HANA schemas as Transient or Virtual InfoProvider
Different Levels of Model-Integration of Field-level Data

Why?

you have the InfoObjects but do not want to stage (now) the data to the EDW
• E.g. Operational (real time) BI (Virtual Provider)
• Open ODS Layer Provider as virtual part of EDW (Virtual Provider)

you do not have all InfoObjects
• InfoObjects available but not for all fields (Virtual Provider or Transient Provider)

you do not want to model InfoObjects
• InfoObjects available but no knowledge about source fields (e.g. 3rd party / legacy load) (Transient Provider)

you do not have InfoObjects
• No EDW model available (Transient Provider)

you do not know the InfoObjects
• E.g. Agile Scenarios (Transient Provider)

*As of now Transient Providers only used in Agile Data Marts
**BW Integration Services—Treat HANA Model as InfoProvider**

**Transient and Virtual Provider on HANA Model**

---

**Different Level of Integration of Field-level Data in BW**

- **Virtual Provider**
  - EDW Provider
  - Transient Provider

- **EDW - EDW Model:** InfoObjects
  - Transient Model: Transient InfoObjects
  - edw Model: Partly assigned InfoObjects
  - Open ODS Layer - Source Models: Fields

- **map & reference**
- **reference & map**
- **stage**

*As of now Transient Providers only used in Agile Data Marts*
Different levels of Integration of Field-level Data
Virtual Provider on HANA Model

Virtual Provider based on a HANA model: new type of Virtual Provider available with BW on HANA

• Modeled like any other Virtual Provider
• All services for InfoProviders and InfoObjects: Modeling (MultiProvider, Composite Provider), Query & OLAP, authorization services
• Complete InfoObject master data services (hierarchies, navigational attributes, authorizations..) for HANA models - joining all InfoObject master data tables to the HANA model
Different levels of Integration of Field-level Data
Transient Provider & Transient InfoObjects on HANA Model

Just publish Hana model in RSDD_LTIP and the Transient Provider is available for querying

Transient InfoObjects: Maintain Reference InfoObjects - optional
Different levels of Integration of Field-level Data
Transient Provider based on HANA Model

Transient Provider:
- Transient means the BW InfoProvider metadata is generated out of the metadata of the source at query runtime: Transient Provider & Transient InfoObjects

Transient Providers can be used similar to other BW InfoProviders for reporting
- Directly (MDX and BICS capable) or
- Creating BEx Queries on top the complete set of Analytical Functions (Restricted / Calculated key figures, Exceptions, e.a.) is available

Transient Provider fields may reference to a “real” InfoObject meaning
- Inheriting BW InfoObject master data services (like description, texts, display properties, display attributes and hierarchies). i.e. you can create a BEx Query on pure HANA data and model, but use a BW hierarchy and the BW hierarchy processing
- Inheriting InfoObject authorizations
BW Services for LSA++ Open ODS Layer
BW Integration Services - Summery

- Consumption of HANA models in BW – Treat HANA models as BW InfoProvider
  - Transient Provider generated on a HANA model
  - Virtual Provider defined on a HANA model
- Consumption BW models (InfoProvider) in HANA Modeler - Treat BW InfoProvider as HANA view
  - Make BW Models available in HANA Modeler - publish InfoProvider views for usage in HANA Modeler**
- Transfer of HANA schema data into BW* (-> BW EDW Services)
- Transfer of BW data into HANA Modeler managed tables*(-> BW Operational Data Services)

(* SP8/ **Q4 2012)
Holistic picture of

• Externally, HANA Modeler managed data and BW managed data
• Operational BI and EDW based standard BI

BW Integration Services for Open ODS Layer

• Scalable Integration of HANA Models into BW (and vice versa)
  • Modeling, Query & OLAP services, EDW master data, Authorizations for HANA Models

BW Operational Data Services for Open ODS Layer

• ⇒ Real Time Data Replication into BW
  • Extraction or Replication into BW?
• New BW Open ODS Layer Provider
  • Immediate querying on loaded data – no staging to EDW

BW EDW Services for Open ODS Layer

• Managing transfer of data to persistent EDW Providers
• Incremental build of EDW (from virtual to staged scenarios)
• Real time master data in EDW
Open ODS Layer Data Provisioning – Extractors or SLT Replication?

Answering the question ‘Shall I replicate or extract the data?’ seems to be simple: Replication is assumed being ‘cheaper’ than extraction and all that at real time

Answering this question is not that straightforward if we look to the complete picture from business solution perspective:

1. BI solution & data freshness - Operational BI solutions may ask for real time and/ or right time and/ or stable snapshots (scheduled, on request) and

2. BI solution & consistency – BI on an EDW what mean delivered data become
   • a source for persistent EDW Layers (Open ODS Layer as Acquisition Layer) or
   • a virtual part of the EDW and

3. BI solution and reproducibility, availability …

4. BI solution and the contribution of the delivered data content to the desired solution, i.e. to the Data Marts regardless whether virtual or persistent ones

* BW 730 SP8
LT Replication Concept: Trigger-Based Approach
Architecture and key building blocks (for SAP Sources)

- Efficient initialization of data replication based on DB trigger and delta logging concept (as with NearZero downtime approach)
- Flexible and reliable replication process, incl. data migration (as used for TDMS and SAP LT)
- Fast data replication via DB connect LT replication functionality is fully integrated with HANA Modeler UI
Real-time Data Replication into SAP BW
Data Replication to SAP BW using SAP LT Replication Server

- Replicating Data of any SAP System (or non-SAP) into SAP BW
- Enabling real-time data supply into SAP BW (PSA) via WebService DataSource
- Real-Time data processing from PSA via SAP BW Real-time Data Acquisition (RDA)
  - into a DataStore Object (DSO) or master data tables (MD)
  - New Operational DSO (planned 2013)
- As of today SLT replication into BW on ‘How to’ paper level (on request)
- Full imbedding in SLT of replication into BW planned Jan/ 2013
Open ODS Layer
BW Extractors and SLT Replication- Overview

SAP Source

Replicating
DB calls

Extracting
record images

SLT
Replication

SAP BW Extractor

SAP BO DS**

DB calls

RFC calls

RFC calls

DB calls

HANA Table

PSA

Operational DSO*

* Planned 2013 ** if no BW in place
SLT Data Replication to HANA or BW
Delivering Record as Insert-Images or DB-Calls

Source-Table DB calls

<table>
<thead>
<tr>
<th>DOC</th>
<th>CST</th>
<th>WGHT</th>
<th>DB CALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>4711</td>
<td>1</td>
<td>400</td>
<td>INS</td>
</tr>
<tr>
<td>4711</td>
<td>1</td>
<td>500</td>
<td>UPD</td>
</tr>
<tr>
<td>4711</td>
<td></td>
<td></td>
<td>DEL</td>
</tr>
</tbody>
</table>

SLT Replication

DB calls / records:
- INSERT
- UPDATE
- DELETE

Record Images:

<table>
<thead>
<tr>
<th>TI</th>
<th>Record Mode</th>
<th>Short text</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Before-Image</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Add</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Delete (Key Only)</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>New Image</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>Reverse-Image</td>
<td></td>
</tr>
</tbody>
</table>

Operational DSO*

Open ODS Layer

* Operational DSO planned 2013
SLT Data Replication to HANA or BW
Differences between Insert-Image and direct DB-Call Replication

Source-Table DB calls:

<table>
<thead>
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</tr>
<tr>
<td>4711</td>
<td></td>
<td></td>
<td>DEL</td>
</tr>
</tbody>
</table>

Table content after DB calls:

<table>
<thead>
<tr>
<th>DOC</th>
<th>CST</th>
<th>WGHT</th>
<th>DB CALL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

HANA table:

- No record

Real Time BW PSA:

- Open ODS Layer

Delta?

Snapshots?

Real time?

BW generic delta

Snapshots?

Real time?
Open ODS Layer
Replication & Extraction Data into BW vs. directly into HANA DB

BW is a DWH (application)
- A DWH & BW principle is keeping history of delivered data and leaving the decision what shall happen to the received records to the BW owner.
  - i.e. the BW Inbound Provider (PSA, Operational DSO*) never delete records - all records are inserted with an image classification (insert, before, after, reverse, delete … image)
- In addition each record gets a unique stamp (request, package, rec-no), which allows a generic delta for further data processing (staging or immediate querying)

HANA is first of all a data base
- Any delivery of data to a HANA inbound table means a direct data base operation
- All necessary or wanted record handling must be done either by the replicator or the extraction tool – if possible at all
  - Content enrichment / Content transformations
  - Providing a delta criteria for further processing (any kind of snapshot, EDW)
  - Managing delete HANA calls

* Planned 2013
Open ODS Layer - Replicating Data into BW
BW Multi-Service Offering on Top of Real Time PSA

Real time BW PSA:

- Real time Operational BI
- Real time on demand Operational BI
- Scheduled snapshot Operational BI
- Real time EDW based BI
- Consistent Images EDW Propagator
- All Images EDW Corporate Mem

Operational DSO*
HANA DB DSO/ Operational DSO*

EDW Layers:
- std DSO, InfoObject
- std DSO
- WO-DSO

* HANA DB DSO BW 730 SP8/ Operational DSO planned 2013
As BW customer the question ‘Shall I replicate or extract the data?’ can be answered like

- **In case I decide for replication, I replicate into BW** (full embedding into SLT 01/2013)

- **BW replication & BW extraction inbound data offer the same services**
  - Immediate querying (Near real time: Via RDA & DSO, InfoObject and planned Operational DSO*)
  - Generic delta for further data processing
  - Transformations

- **Thus for BW customer decision between replication & extraction is reduced to considering**
  - the delivered data content
  - desired data freshness by business solution
Open ODS Layer - BW Extractors or SLT Replication
What is delivered? Delivered Content & Business Logic

Replication of source tables
- target needs to know
  - table associations
  - table content logic
- latency: real time delivery
- delta: 1:1 replication of DB-operations

SAP Δ Queue Business View Extractors
- delivered data are data mart ready
- inbuilt associations & content logic
- latency: extraction cycle
- delta (SAP Δ queue, full)

SAP Generic Table/ View Extractors
- source table/ view level
- latency: extraction cycle
- delta (complete ? / full - lost deletes)
- often only full loads
Open ODS Layer- BW Extractors or SLT Replication
Delivered Content as Decision Criteria

- SAP Generic Table/View Extractors are candidates for replacement as they do not offer from delivered content perspective any added value compared to replication and have technical ‘deficits’
  - Generic full extractors
    - Cannot catch deletes what makes EDW processing cumbersome
    - Will be processed even if there are no changes (e.g. master data)
  - Generic delta extractors - need of a safety interval what makes the business unhappy (latency of data)

The trigger based SLT replication enables a delta mode for all tables (as it is a technical approach, no delta capable field is required)

- SAP Extractors working with the SAP \( \Delta \) queue often address multiple tables joining them with complex logic - they cannot easily be replaced by replication as the complex logic has to be built on the replicated HANA tables / BW Provider
Holistic picture of
- Externally, HANA Modeler managed data and BW managed data
- Operational BI and EDW based standard BI

BW Integration Services for Open ODS Layer
- Scalable Integration of HANA Models into BW (and vice versa)
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BW Operational Data Services for Open ODS Layer
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LSA++ Open ODS Layer
BW Operational Data Services – New BW Provider for Operational BI

• New field-level BW Provider
  ➢ HANA DB DSO*
  ➢ Operational DSO*
  providing
  – immediate querying - no staging into EDW required and
  – data transformation services

• Transfer of BW data into externally HANA Modeler managed tables
  – Replicating and Transforming BW data into HANA tables
    BW Open Hub Services for transformation & consistent transfer into HANA tables or HANA DB
    DSO*

(* HANA DB DSO SP8/ Operational DSO planned for 2013)
LSA++ Open ODS Layer (BW 730 SP8)
BW Managed Inbound Data for EDW & Operational BI

BW enables Operational BI on BW managed inbound data via an HANA DB DSO linked to the PSA & generated HANA analytic views (*SP8)
BW DataSource Services

HANA allows immediate performant querying on loaded data without any specific modeling (e.g. star schema) or tuning efforts (e.g. aggregates). This is a (necessary) prerequisite for Operational BI/ real time BI.

In order to leverage this HANA capabilities BW on HANA provides (will provide) new Operational / real time BI Services for data at the earliest possible point in time.

The earliest point in time where BW has meta-knowledge about data is BW DataSource.

BW DataSource Services

- Open Hub Service *
  - Delivery Services
  - HANA DB DSO/ table
  - Transformation Services

- PSA Service
  - EDW Services
  - Consistency Services
  - Real time data Services

- Operational DSO **
  - Operational Data Services
  - EDW Services
  - Consistency Services
  - Transformation Services
  - Real time data Services

(* SP8/ ** planned for 2013)
BW Operational Data Services
Querying on BW Inbound Data New HANA DB DSO (BW 730 SP8)

BW Query, OLAP & Authorization Services

BW Virtual/ Transient Provider on HANA Models

Analytic views generated

HANA Table

HANA DB DSO

DataSource Service - Open Hub:
- Delivery Services
- Transformation services

DTPs

PSA

DataSource Service - PSA:
- Consistency services
- Staging services

Externally managed

Open Operational Data Store Layer

BW managed

SAP ETL: InfoPackage
SLT replication:
Real Time InfoPackage
BW Operational Data Services - BW Managed
Provisioning, Staging & Query Services - New Operational DSO (*planned 2013)
Open Hub Service
HANA DB DSO as DataSource Service
HANA Footprint of HANA DB DSO
HANA DB DSO as Open Hub Service Target
Set up & Usage

- Field-based DSO with Activation-Queue and Active Table
- Works like a ‘normal’ DSO
- Field list generated as proposal from DataSource (additional fields possible)
- Filled from PSA by Open Hub Service, which is generated as a DataSource Service providing HANA DB DSO name and HANA schema
- DTP (not yet RDA) generated
- Transformations between PSA and HANA DB DSO allow enrichment
- Analytic view generated in defined HANA Schema

Usage:
- Consistent, queryable replication (with transformation) of BW PSA data to HANA Modeler
- Enable immediate BW querying and Services to source-level data – no staging into EDW context necessary – Open ODS Layer HANA DB DSO as virtual part of EDW (if feasible)
Holistic picture of
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BW Services for LSA++ Open ODS Layer
BW EDW Services – Open ODS Layer as Source

• Open ODS Layer Provider as source for persistent EDW Provider
  – BW Open ODS Provider (PSA & Operational DSO**) as source for EDW
    o Consistent generic delta for data transfer
    o Data Transformation Services
    o Mapping Services for source-level fields to EDW data model (InfoObjects)
  – Externally managed data (HANA tables/ views) as source for EDW
    o Transfer and Transformation of HANA schema data into BW: BW Data Transfer and Transformation Services (remote BW DTPs*)
    o Providing a valid delta criteria is the task of the HANA schema data

(* SP8/ **Operational DSO planned for 2013)
LSA++ treats HANA schemas as Open ODS Layer Provider that are externally managed (modeling and load)

* DTP with SP8
BW Services for LSA++ Open ODS Layer
BW EDW Services – BW Open ODS Layer Provider as Source

Consistent, reliable, reproducible Staging from PSA or Operational DSO* to EDW

(* planned for 2013)
Master Data (InfoObjects) are the heart of the EDW

- Loading master data
  - is cumbersome because of the number of entities
  - means for most of the entities full loads ⇒ with slowly changing dimensions most master data did not change since the last load ⇒ most records are loaded unnecessarily
  - is challenging with global BWs (right time)
  - was a cumbersome with BW on RDBMS (realignment of aggregates – change run)

With BW on HANA updating InfoObject master data tables means so to speak a NOOP ⇒

Full master data extraction & loads from single source tables can be replaced by real time replication via SLT into BW and transfer to InfoObject tables via 'real time‘ DTP (RDA)

Extractions for core entities (e.g. material) are often joins on several source tables. In this case the replacement must be carefully examined.
Value of real time master data:
- no more synchronization issues with transaction data (simplified staging)
- less administration and operations overhead
- simplified projects on BW EDW
- overall increased flexibility
**LSA++ Open ODS Value Scenarios & BW Services**

**Holistic picture of**
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**BW EDW Services for Open ODS Layer**
- Managing transfer of data to persistent EDW Providers
- Incremental build of EDW (from virtual to staged scenarios)
- Real time master data in EDW
Virtual integration of Open ODS Layer Provider with EDW

- If an Open ODS Layer Provider fulfills the consistency criteria of the EDW (customer defined e.g. integrity, reproducibility…) it may well serve as virtual part of the EDW Propagation Layer
  - Using the Virtual Provider service on HANA models (view on HANA tables or HANA DB DSOs *)
  - Using Operational DSOs*

  hence reduce redundancy (TCO) and increase responsiveness.

A later staging of the Open ODS Layer Provider to a persistent EDW Propagation Provider is possible if it offers a valid delta – (for BW managed Provider this is always the case)

(* HANA DB DSO SP8/ Operational DSO planned for 2013)
Customers invested a lot in SAP ECC resulting in highly integrated processes and master data =>
It is straightforward making SAP ERP(s) their reference system:

The data loaded from this SAP ERP to BW are by definition in a good shape i.e. we assume that
normally no integration transformations are necessary.
All other data have to be transformed with respect to this reference to integrate and harmonize with
the (SAP ERP) reference.
Providing Immediate Value of Loaded Data (1st Step)

BW on HANA is targeting to provide immediate value i.e. Local/operational BI without obabstracting EDW targets allowing to introduce incrementally an EDW data model (InfoObjects) and additional LSA++ Layers when it shows up value.
LSA++ Open Operational Data Store Layer - Summary

Flexibility – Immediate Value

- The new Open Operational Data Store is the LSA++ Inbound Layer.
- The target of the Open ODS Layer is to provide a common framework for BI source level data.
- Open ODS integrates data delivered directly to BW (BW managed) and data delivered to native HANA models (externally managed).
- The Open ODS data inherit the field-level (OLTP) data model from the source application.
- The Open ODS Layer promotes scalable BW Services like OLAP services, master data services, authorization services...
- The Open ODS is a hybrid, offering
  - Acquisition Layer functionality serving as source-layer for the EDW Layer
  - Immediate querying** on data
    - SAP extraction (SAPI)
    - Data Services for non-SAP sources
    - Real time replication via SLT

(** HANA DB DSO SP8/ Operational DSO planned for 2013  (*on the same HANA instance)
LSA++ Virtual Data Mart Layer
LSA++ Holistic Architecture
Virtual Data Mart Layer - Overview

** HANA DB DSO SP8/ Operational DSO planned for 2013)
LSA++ Holistic Framework
Virtual Data Marts: Virtual Wrapping & Combining Data

LSA++ promotes flexible virtual wrapping of agile / operational data and virtual combinations (with core EDW context data) using BW on HANA virtualization features (Virtual Data Marts: Virtual Provider, Transient Provider, Composite Provider)

→ Virtual Data Marts will increase overall LSA++ framework flexibility and manageability
With LSA++ framework Virtual Data Marts come into focus. Beside the various technical types of InfoProvider (VirtualProvider, TransientProvider, CompositeProvider, MultiProvider) we see a wide variety of scenarios addressed by Virtual Data Marts.

**Virtual Data Marts**
- flexibility
- time-to-market

**Reporting on Open ODS data**
- consistency - source dependent
- integration - source dependent
- robustness, availability - source dep.
- reproducibility - source dependent
- latency, freshness – load dependent

**Mixed reporting on Open ODS & EDW data**

**Reporting on EDW data**
- consistency – standardized
- integration – standardized
- robustness, availability – standardized
- reproducibility – standardized
- latency, freshness - standardized
Criteria Structuring LSA++ Virtual Data Mart Layer

**Virtual Data Marts Context:**
- Virtual Data Mart wrapping a HANA view versus Virtual Data Marts resulting from joining (CompositeProvider) other Virtual Data Marts
- Technical provider type (Virtual, Transient, Multi, Composite)
- Addressed layer
- Content area of addressed data
- Different level consistency aspects joining data (e.g. Inner versus left outer join)
- Ownership: reach (for whom e.g. Global, regional, market,..)
- ..... 

**LSA++ suggests a proper structuring (layering) and naming of Virtual Data Marts deployed via Promote-To-Production reflecting the context of Virtual Data Marts not loosing control**
Virtual Data Mart wrapping a HANA view versus Virtual Data Marts resulting from joining (CompositeProvider) other Virtual Data Marts

Please remember the restrictions of Basis & Joined Virtual Data Marts!
Virtual Data Mart Criteria for Structuring – Naming Proposal

• **Virtual Data Mart Layer** (1 Byte)
  - W – wrapped, I – joined/union

• **Technical provider type** (Virtual, Transient, Multi, Composite): (1 Byte)
  - V – VirtualProvider
  - T – TransientProvider
  - M – MultiProvider
  - C - CompositeProvider

• **Addressed Layer**: e.g. OP (ODS & Propagator) (2 Byte)

• **Content Area** of addressed data (4 Byte)
  - Inherited or assigned

• **Different level of 'consistency' resulting from join** (1 Byte)
  - I – inner join (referential integrity)
  - O – outer join (all)
  - U - Union

• **Ownership: reach** (for whom e.g. Global, regional, market) (1 Byte)
With BW on RDBMS we were limited but the LSA was simple.

With BW on HANA we gain more flexibility and more options covering business needs – this on the other hand requires a new holistic LSA++ providing a framework for all different BI-flavours and their persistent data and virtual data marts

Please remember: we are just at the beginning of a great journey
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