Agenda

Motivation

SAP Solution Manager as Tool for Data Consistency Management

- Transactional Correctness (TC)
- Guided Self Service Data Consistency Management (GSS DCM)
- Internal Database Comparison (IDC)
- Cross Database Comparison (CDC)
- Data Consistency and Interface Monitoring

Additional Information
Motivation
Motivation: Why is Data Consistency Management needed?

Is the data exchanged between the systems as well as the data needed for correct operation of the business process consistent?
Motivation: Domino Effect – Influenced Systems

Incorrect Sales Org in one table
Create Sales Orders in ECC
Create Invoice
Create FI- Documents
Period End Closing
Financial Reporting
Examples from SAP’s Backoffice:

- Database Crash at a customer and last backup ~12 months old
- Inconsistencies between MM and FI during goods movements with unknown Root Cause
- A custom made report has accidentally deleted parts of business objects
- Some data has been replicated multiple times between two systems
- Data storage in multiple systems using sRFC/HTTP within one business step
- …
Motivation: Why can Data Inconsistencies occur?

**User Level:** Data inconsistencies due to
- Real world operation ≠ system transaction
- Incorrect manual entry of data
- Completely missing entry of data
- Wrong usage of transaction

**Application Level:** Data inconsistencies within one system or between two systems due to
- Absence of error handling
- No clear leading system defined
- Logical inconsistencies in application integration
- Errors in application programs (transactional correctness)

**Technology Level:** Data inconsistencies due to
- Data Loss
- Initial Loads may have run into problems
- One system crashes and is reset to an earlier state
- Problems with Delta Loads
Motivation: Inconsistency Types

Type A
- Customer Smith
- Address: New York City
- CRM System
- Address: New York City

Type B
- Customer Smith
- Address: New York City
- CRM System
- Address: Berlin

Type C
- Customer Smith
- Address: New York City
- ECC System
- Address: New York City
Motivation: Differences

Time $t_1$

| CRM System | Customer Smith  
| Address: New York City |

| ECC System | Customer Smith  
| Address: New York City |

Time $t_2$

| CRM System | Customer Smith  
| Address: Berlin |

| ECC System | Customer Smith  
| Address: New York City |

Time $t_3$

| CRM System | Customer Smith  
| Address: Berlin |

| ECC System | Customer Smith  
| Address: Berlin |
Data Consistency Management: Relation to other areas in Business Process Operations

**Business Process Improvement**

- DCM might improve the throughput through business processes and reduce the document backlog.

**Data Consistency Management**

- DCM jobs have usually long runtimes & restrict the execution of other jobs which shouldn't run in parallel.
- DCM might solve or prevent alert situations.

**Job Scheduling Management**

- Archiving Run 1000 Billing Run
- Backup Run 2000 Reorganization
- Transports Run 3000

**Business Process Monitoring**

- Send Unsent Order
- Create Sales Order
- Perform Order Rescheduling
- Create Outbound Delivery
- Create Shipment
## Data Consistency Management: Benefit / Value proposition

<table>
<thead>
<tr>
<th>Goal</th>
<th>Benefit</th>
<th>Challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparency</td>
<td><strong>Global transparency across organizational units &amp; process variants</strong></td>
<td>…increase visibility of current data quality and consistency state.</td>
</tr>
<tr>
<td>Efficiency</td>
<td><strong>Reduced operating costs</strong></td>
<td>… automate data consistency management and reduce manual process inefficiencies and human errors. Avoid systematic process exceptions.</td>
</tr>
<tr>
<td>Effectiveness</td>
<td><strong>Higher customer satisfaction &amp; faster revenue stream</strong></td>
<td>…avoid delayed business documents and financial losses by quick reaction to interface errors affecting data of core business processes</td>
</tr>
<tr>
<td>Clean-up</td>
<td><strong>More accurate business reporting</strong></td>
<td>…avoid inaccurate reporting data by ensuring consistency between systems and quicker clean up due to earlier detection</td>
</tr>
<tr>
<td>Internal Audit</td>
<td><strong>Higher reliability of financial reporting &amp; possible detection of fraud</strong></td>
<td>…avoid inconsistencies in FI-AP and FI-AR before PEC. Review consistency between MM &amp; FI and between systems.</td>
</tr>
</tbody>
</table>
Data Consistency Management: Handling Overview

1. Prevent
   - Process Design & Training

2. Detect
   - End-to-End Monitoring

3. Investigate
   - Root Cause Analysis & Business Continuity Concept

4. Correct
   - Reconciliation Strategy & Business Continuity Concept
Data Consistency Management: Deliverables

**Prevention**
- Review of the Process Design
- Transactional correctness check
- Setup Monitoring & Exception Handling
- Establish a suitable Change Management
- End User Training of correct system usage
- Provide Best Practices

**Detection**
- End-to-End Consistency Check Reports
- Data Consistency and Interface Monitoring as part of Business Process Monitoring
- Internal Database Comparison (IDC)
- Cross Database Comparison (CDC)

**Correction**
- Root-Cause Analysis to determine the origin of the inconsistency
- Correction of the inconsistent data
- Data Consistency Toolbox / Guided Self-Service Data Consistency Management
- Guided Procedures in Cross Database Comparison

**Investigation**
- Determination of the Business Impact
- Check the availability of a Fall-Back Scenario
- Data Consistency Toolbox / Guided Self-Service Data Consistency Management
- Guided Procedures in Cross Database Comparison
Data Consistency Management: Tool Overview

**Data Consistency and Interface Monitoring**
- Send Urgent Order
- Create Sales Order
- Performs Order Rescheduling
- Create Outbound Delivery
- Create Shipment

Proactively ensure reliable business process flow and data consistency

**TC Tools for ABAP and Java**
Find problems with transactional correctness in ABAP or Java code

**DC Toolbox / GSS DCM**
Provide tools and tasks to check or correct inconsistencies

**Cross Database Comparison**
Check whether data is consistent between two systems especially if one is a non-SAP system?

**Internal Database Comparison**
Check whether two linked tables are consistent or have the correct content?
Data Consistency Management: Business Justification
Example: Without DCM

Example effort estimation (as-is)

- **3 days** to determine the right tools and procedures for data inconsistency determination and repair * 1 persons → **3 person days**
- **7 days** * 3 persons to determine and fix inconsistencies → **21 person days**
- Inconsistencies last **10 days** * 100 affected users * 0.2 (each user spends 20% of his day for workarounds) → **200 person days**

∑ 224 person days

Possible efforts

- Effort to determine the right tools and procedures for data inconsistency determination and repair
- Effort for (constant) data inconsistency determination
- Effort for (constant) data inconsistency repair
- Effort for workarounds to determine correct and consistent data
- Effort for workarounds because business processes are not available in system

The highlighted numbers can be reduced
Example effort estimation (to-be)

- **1 days** to determine the right tools and procedures for data inconsistency determination and repair * 1 persons → 1 person days
- **4 days** * 3 persons to determine and fix inconsistencies → 12 person days
- Inconsistencies last **5 days** * 100 affected users * 0.1 (each user spends 10% of his day for workarounds) → 50 person days

\[ \sum 63 \text{ person days} \]

Possible efforts

- Effort to determine the right tools and procedures for data inconsistency determination and repair
- Effort for (constant) data inconsistency determination
- Effort for (constant) data inconsistency repair
- Effort for workarounds to determine correct and consistent data
- Effort for workarounds because business processes are not available in system

The highlighted numbers have been improved
Transactional Correctness (TC)

SAP Solution Manager as Tool for Data Consistency Management
Motivation for Transactional Correctness

Do my programs ensure data consistency?

What happens in case of errors?
Transaction Correctness: Introduction

**Motivation**
- Business process and interface steps must be programmed in a way to ensure data consistency even in case of errors

**Goal**
Identify and improve programs that can lead to inconsistencies

**Deliverable**
A tool that helps identifying parts of programs that can possibly lead to inconsistencies
Transaction Correctness
Example: Sales Order Management

System 1

- Receive Data
- Process Data
- Send Updated Data

System 2

- Create Order Data
  - Send Order Data
  - Receive Updated Data
  - Process Updated Data
  - Post Goods Issue
  - Update Order Data
  - Update Z-Status with Delivery Data

- Create Delivery Data

- Due to an error the goods issue is not posted.
- Inconsistency of the resulting data

- No Error Handling
- No restartability features
Transactional Correctness Tool for ABAP: Example

**Problem**
Data should be inserted together into multiple tables, e.g. header and detail

![Code snippet]

**Question**
Is it possible that data is inserted only in one table but not in the other one?
Transactional Correctness Tool for ABAP: Result

The TC Tool for ABAP shows that the WAIT statement triggers an implicit COMMIT.

In case of errors this can cause data being inserted in the first table but not in the second table.

The TC Tool for ABAP checks more rules that have to be followed to ensure Transactional Correctness and can be executed as a standalone tool in the managed system.
Transactional Correctness with End to End Trace in Solution Manager Work Centers
The TC Check in the E2E trace shows the same result as the standalone tool
Transactional Correctness Check in E2E Trace: Result for RFC Calls

Advantage of the E2E trace is that remote function calls are automatically detected and the TC checks are executed in the right context, e.g. there should be no changes in synchronous RFC calls.
Guided Self Service Data Consistency Management (GSS DCM)
SAP Solution Manager as Tool for Data Consistency Management
Motivation for Guided Self Service Data Consistency Management

How can I analyze and resolve detected inconsistencies?

How can I execute an ad-hoc data consistency check?

How can I structure and document very complex analysis and resolution procedures and their results?
Guided Self Service Data Consistency Management: Introduction

Motivation
- Detected inconsistencies need to be analyzed and resolved
- Some solution lifecycle events require an ad-hoc consistency analysis

Goal
Provide guided procedures to analyze and resolve inconsistencies and to execute an ad-hoc consistency analysis

Deliverable
A tool with the possibility to determine guided procedures to analyze and resolve inconsistencies and to store and report the results
GSS DCM in SAP Solution Manager Work Centers
Guided Self Service Data Consistency Management: Preparation

Select events, systems, modules, business objects and tables
Guided Self Service Data Consistency Management: Analysis

Purpose and procedure for each task
Rating and direct access to programs, transactions and notes needed for the task
User comment
Guided Self Service Data Consistency Management: Report

The Results of a GSS DCM Session can be documented in a Word Report.
Internal Database Comparison (IDC)

SAP Solution Manager as Tool for Data Consistency Management
Motivation for Internal Database Comparison

How can I check data within one SAP system for consistency?

How can I proceed if I face an inconsistency that cannot be detected by standard consistency check tools, but I do not want to write additional coding for each of the required checks?
Internal Database Comparison: Introduction

**Motivation**

- Data in one system needs to be checked for consistency
- Typical situations include unintended partial deletion of data by coding errors (e.g. only header data) or bad quality of master data (e.g. accidental non-execution of transformation reports)

**Goal**

Comparison of two tables to detect missing table entries or inconsistent field contents (any content not corresponding to predefined selection criteria) without the need to write additional coding

**Deliverable**

A tool that identifies, displays and stores inconsistencies together with detailed field content for later reference
IDC in SAP Solution Manager Work Centers
Internal Database Comparison: Example

Problem
Sales order cannot be displayed

Root Cause Analysis
Custom report deleted sales order header data

Question
What documents are affected?
Internal Database Comparison: Example in SAP Solution Manager Work Centers

- Possibility to save parameters as variant
- Remote connection to system where data is located
- Tables that should be compared and join conditions between tables
- Additional restrictions for data that should be compared
- Comparison result
- Use case: missing entries in one table or inconsistencies between tables
- Fields that should be displayed in result
Cross Database Comparison (CDC)

SAP Solution Manager as Tool for Data Consistency Management
Motivation for Cross Database Comparison

How can I check data between different SAP or Non-SAP systems for consistency?

How can I proceed if I face an inconsistency that cannot be detected by standard consistency check tools, but I do not want to write additional coding for each of the required checks?
Cross Database Comparison: Introduction

Motivation

- Data in different systems including Non-SAP systems or XML files needs to be checked for consistency
- Typical use cases include ad-hoc or regular end-to-end comparison of master or transactional data exchanged between multiple systems including Non-ABAP system

Goal

Comparison of two sources to detect missing table entries or inconsistent field contents without the need to write additional coding

Deliverable

An infrastructure that facilitates data modeling and comparison as well as displays and stores comparison results for later reference
Cross Database Comparison: Features

- Built in SAP Solution Manager 7.1 SP01: no add-on needed (except for integration into Business Process Monitoring)
- Offers comparison of multiple tables between two sources
- Supports multiple access paths including RFC, remote database and file access
- Can be enhanced for further access possibilities
- Offers easy to use graphical UI to enter data model
- Extracts data from sources and performs comparison in SAP Solution Manager
- Offers possibility to save and reuse comparison parameters and data model
- Offers functionality to save and display comparison results
- Can extract data using multiple blocks of configurable size
- Supports integration into Business Process Monitoring
Cross Database Comparison: Architecture

SAP Solution Manager

Comparison Object → Comparison Instance → Comparison Group → Correlated Results

Comparison Run

XML File → Comparison Results

BPMon Alerts

Extractor Function Module

SAP System

Generate native SQL query

Generate extractor ABAP coding

Generate extractor program

RFC ADBC

SQL Extraction Statement

Custom-build extractor program

Non-SAP System, HANA-DB

Non-SAP System
CDC in SAP Solution Manager Work Centers
Cross Database Comparison: Comparison Object

Flexible source types like SAP ABAP system, Remote database or XML file

Source type dependent parameters

Graphical data model
Cross Database Comparison: Comparison Run Overview

Overview which comparison runs are finished, aborted or still running and if inconsistencies were detected

Comparison status text and progress of comparison

Message text, error message in case of aborted comparison

Click hyperlink
Cross Database Comparison: Comparison Run Result

- Navigation including history graphics
- Global result parameters – switch between comparison run IDs and iteration IDs
- Result overview including graphic
- Details for inconsistency type marked in overview
Data Consistency and Interface Monitoring

SAP Solution Manager as Tool for Data Consistency Management
Motivation for Data Consistency and Interface Monitoring

Where is data consistency checked?

When is data consistency checked?

Who checks data consistency?
Data Consistency and Interface Monitoring: Introduction

**Motivation**
- Data consistency needs to be checked on a regular basis
- Automation of effort

**Goal**
Detect inconsistencies as early as possible

**Deliverable**
Process oriented monitoring objects for the most common data consistency reports and interface technologies
Data Consistency Monitoring: Results

Interface Errors and Data Consistency

Number of Errors

DCM Result

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Interface Monitoring: Results
Interface Monitoring vs. Data Consistency Monitoring

Interface Errors and Data Consistency

Short term error resolution
Long term safety net

Number of Errors

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Business Process Monitoring
Information Flow – High-level Overview

People

Solution Manager

Solution Landscape

Customer 54
Alerts from Data Consistency Monitoring in Solution Manager Work Centers (1)
Alerts from Data Consistency Monitoring in Solution Manager Work Centers (2)
Data Consistency Monitoring
Example: General Ledger versus Sub Ledger (SAPF190)

Navigation from alerts to the results that caused the alert

Regular analysis of consistency between General Ledger and Sub Ledger (SAPF190)

Automated alerting in case of inconsistencies for selected objects, based on selected threshold values
Interface Monitoring
Example: IDoc Monitoring
BW trend analysis is available for all data consistency monitoring objects in SAP Solution Manager, allowing you to identify the long term trend for the occurrence of inconsistencies.
What does Data Consistency Monitoring mean in Practice?

Data Consistency Monitoring means to answer the following questions:

- Who is responsible and checks for background job scheduling and regular monitoring of consistency check programs like LX23?
- Who monitors and checks for update errors (SM13), application log messages (SLG1)?
- Who monitors the interfaces?
- Who has to be contacted in case of the occurrence of an inconsistency?
- What has to be done if a certain inconsistency arises?
- Who is responsible for transactional correctness testing of developments?
- Where can I find this information?

… and to detect inconsistencies as early as possible.
Content for Data Consistency Monitoring: Monitoring Objects related to Data Consistency

Cross-Application Monitoring Objects

General Application Log (SLG1)
Short Dumps
Update Errors (Transaction- / Program-specific)

Interface Monitoring Objects

qRFC Alert Monitoring
BDoc Alert Monitoring (CRM)
ALE/IDoc Alert Monitoring per IDoc Type
XI/PI Alert Monitoring
Batch Input Monitoring
File Monitoring
CRM Middleware Monitoring

Customer Specific Monitoring Objects

Customer Exits in Business Process Monitoring Infrastructure
Objects available via CCMS Monitoring Infrastructure
Content for Data Consistency Monitoring: Monitoring Objects *specific for* Data Consistency

**Enterprise Resource Planning Logistics**
- Sales & Services
- Warehouse Management
- Inventory Management

**Enterprise Resource Planning Financials**

**Supply Chain Management**
- liveCache - Database
- CIF-Interface

**Extended Warehouse Management**
- Stock Information
- Further Checks

**Customer Relationship Management**

**Generic Check Functions**
- Internal Database Comparison
- Cross Database Compare
- Custom Developed Consistency Reports

**Industry-Solutions**
- Retail
- IS-OIL
- Banking
Additional Information
## Data Consistency Management: Main Implementation Scenarios

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IT</strong></td>
<td><strong>Business</strong></td>
<td><strong>IT</strong></td>
</tr>
<tr>
<td>Monitor technical aspects of inconsistencies (interfaces)</td>
<td>Identify and monitor business related aspects of inconsistencies (standard reports)</td>
<td>Monitor business related impact of interfaces</td>
</tr>
<tr>
<td>SAP Business Process Analysis (cross-application part) performed on SAP backend system</td>
<td></td>
<td>Extend consistency and interface monitoring using custom made reports</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extend consistency checks using generic check reports</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Identify interfaces (technologies) of concern</td>
</tr>
</tbody>
</table>
Additional sources of information

Customer Information

Detailed Information about DCM Functionalities in SAP Solution Manager can be found at http://service.sap.com/dcm → Media Library (Sub-sections: “Overviews and Demos”, “Best Practice Documents”, “Technical Information” and “Customer Examples”)

DCM Standard - available at http://service.sap.com/supportstandards → Media Library → Data Integrity and Transactional Consistency


Additional information related to Monitoring in the context of Business Process Operations can also be found at http://service.sap.com/bpm → Media Library → Technical Information
Thank you!