# A Complete Guide to System Refresh Automation for SAP HANA<sup>®</sup> with Libelle

Architecture, Features, and Benefits





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# Management Summary

#### Introduction

This Whitepaper outlines common system refresh challenges, and how Libelle's **System***Copy* (LSC) automation solution can fully orchestrate and accelerate the refresh execution. It includes a dedicated section with concepts and considerations for refreshing SAP HANA including Suite on HANA and S/4 HANA.

### What are System Refreshes?

System refreshes are part of the SAP application lifecycle management process of developing, testing, and maintaining functionality in SAP landscapes. A system refresh is the process of refreshing production support systems with current production data. Traditional production support systems typically include a minimum of two of the following:

- Development Systems (DEV)
- Sandbox Systems (SBX)
- Quality Assurance Systems (QAS)
- Any additional, non-production systems e.g. for projects or an N+1 landscape.

System Refreshes are understood as complete homogeneous system copies. Data Slicing where only a subset of data is copied to a QAS system is not covered. In fact, such data slicing requirements are slowly disappearing due to their complexity, the typically narrow use-case within the very complex SAP data model, and the availability of full-scale refresh automation with speedy and automated execution via implementing solutions like LSC.

'System Refreshes' in the context of Libelle means both Homogeneous System Copies and Client Refreshes. Data Slicing or Heterogeneous Migrations are not covered by Libelle.

Client Copies are covered with Libelle – there are many instances where client copies make perfect sense. They are used either as local or remote client copies for example with Development systems or if there are multiple clients in QAS systems. Finally, System Clones where new SAP systems are duplicated from existing systems, are covered with Libelle using a custom repository.

The diagram below shows a sequence of System Refreshes, System Clones, local Client Copies, and remote Client Copies. LSC provides end-to-end automated workflows for most common scenarios. The processes outlined in the Whitepaper are centered around the actual System Refresh process using Libelle's **System***Copy* (LSC) solution. The vast majority of points presented apply equally to Client Copies and System Clones.



Figure 1 – System and Client Refreshes Sources and Destinations

### Refresh Challenges and Opportunities

Production support systems within SAP landscapes are designed to fulfil a specific role and deliver dedicated functionality in the application lifecycle. With that, creating a single QAS system involves considerations for more than 50-80 different areas within the SAP application after the database was copied from production. This including settings such as users, security, logical system name conversions (BDLS), RFC connections, transports, STRUST settings, to name only a few.

Main challenges of a workflow that is not fully automated includes the fact that the process is prone to errors and mishaps when executed manually. Wait periods in the process prevent Administrators to focus on the workflow. Human labor cannot easily be cascaded across multiple refreshes. Finally, the manual process is intrusive: Production Support systems are unavailable during refresh.

Manual executions of System Refreshes are expensive in multiple dimensions: They are time-, labour-, and know-how intensive. It is a repetitive process and multiple systems require several refreshes regularly. Systems are down for hours or days during execution.

Automating refreshes end-to-end and centering the workflow around an orchestration solution such as LSC, brings many opportunities for the business:

- **Highly predictable**: Refreshes are part of the lifecycle and have to be delivered. Predictability leads to IT and business being more confident in the results and requesting more refreshes.
- **Higher refresh frequencies:** Delivering refreshes in hours instead of days allows for more refreshes. Customers can increase refresh intervals to quarterly or monthly from annually.
- High Span of Control: For years, outsourcing to low-cost SAP service provider was the only option to manage complexity and improve the bottom line for the business. Today, with software such as LSC, customers can take control back into their own hands without dependency on a single consultant or service provider. The workflow is owned by the customer.
- Lower Operating Costs: Refresh automation allows the IT department to be more flexible with lower operating costs, aggressively increase operational efficiency of own operation, and reduce endless attention to repetitive tasks.



### The Software-Defined System Refresh

Libelle coined the term "Software Defined System Refresh" applying orchestration in the context of virtualization and cloud services where a workflow of provisioning services gravitates around a standardized workflow that is fully managed by Software as shown in the diagram below.



#### Figure 2 – The Software-Defined System Refresh

SAP already provides dedicated guidelines for a standardized workflow how system refreshes ought to be executed. Customer procedures to cover items such as handling of Z-Tables are usually standardized on an organizational level. Finally, Libelle executed thousands of refreshes using LSC adding more standardized workflows with variations how certain scenarios are handled best. All that is needed from here is to wrap the LSC Automation and Orchestration Framework around the process. Now, customers can have their valuable senior staff focus on managing execution and exceptions, instead of calling T-Codes.

The Software-Defined System Refresh helps IT to transition from iterating the same repetitive manual or semi-automated tasks to become a service broker.

### What is Libelle **System**Copy?

Libelle **System***Copy* (LSC) automates and accelerates homogeneous system copies for SAP systems. As outlined above, System Refreshes are required to provide production support systems (e.g. QAS or DEV) with current production data. Such refreshes often take days or weeks to complete with multiple administrators working non-stop to deliver. LSC comes with nearly 500 pre-configured tasks covering all steps required for a typical refresh. A powerful, yet simple and easy-to-use orchestration and automation



engine drives the process of building, configuring, and cascading templates across your SAP landscape. The execution of refreshes and exception handling is managed through a highly functional and easy-touse GUI. LSC supports SAP System Refreshes for NetWeaver-based systems including S/4 HANA, ECC, CRM, SCM, BI, GRC, and most all SAP implementations. LSC supports all major databases including SAP HANA, SAP ASE, SAP MaxDB, MS SQL Server, DB2, and Oracle on AWS Windows and AWS Linux platforms.

LSC has three main components: a powerful, yet simple-to-use Automation Framework, an extensive Task Repository with almost 500 pre-configured refresh tasks, and a Management Console for Administrators to configure and execute refreshes.

# System Refresh Phases

System Refreshes are comprised of four phases with each phase entailing dedicated steps which Libelle refers to as Refresh 'Tasks'. The steps have to be done either done manually absent of a tool, or are fully automated using Libelle **System***Copy* (LSC). The phases are as follows:

#### Check Phase

During the LSC Check Phase source and target kernel versions and ABAP component versions are checked. Also, connectivity, client settings, and logical system names are validated. The Check Phase can be executed any time prior to a refresh. For development refreshes, there are additional steps that are taken like committing and closing open development work.

#### Pre-Processing Phase

Pre-Processing happens right before the actual QAS system is shut-down prior to the actual refresh starts. This can happen while users can still be using the system. Main goal is to the export and management of approximately 70 T-Codes such as BD54, DB13, DB59, RZ04, RZ10, RZ20, RZ70, SCC4, SCC7, SCC8, SE03, SE06, SE38, SE61, SE80, SECSTORE, SM02, SM14, SM28, SM 37, SM 38, SM51, SM58, SM59, SM61, SM65, SM69, SMMLG, SMQR, SMQS, SMT1, SMWO, SNC, SP12, SR13, SS02, ST03, STMS, STRUST, WE20, and more. Other Pre-Processing tasks include export of JAVA configuration and an inventory of pending transports so that they can be re-applied in post-processing.

#### Copy Phase

During the Copy Phase, a complete physical or snapshot copy of the production database is executed. This can be a live copy directly from production, or an automated restore from a previously created backup. The Copy Phase works slightly differently for the different database (HANA DB, SAP ASE, SAP MaxDB, Oracle, MS SQL, or DB2). Additional pre-, and post-database copy steps are managing settings such as HANA DB users, or recovering specific redo-log files to achieve a landscape-wide consistent recovery point across multiple SAP Systems (for example if ECC, BI, and CRM are refreshed together).



#### Post-Processing Phase

Post-Processing typically presents the highest amount of work and time during the refresh. It requires the import and management of appropriate T-Codes exported in Pre-Processing. JAVA configuration settings are imported and Logical System Name Conversions are executed. Background screens are restored, and transports are re-imported either with or without an optional manual validation. Finally, the SAP systems need to be started in the correct sequence of starting Central Instance first, Application Server second, and grant users' access at the end.

### Data Masking Phase

System Refreshes are often followed by an automated data masking phase or 'data sanitation' phase. This process removes sensitive data from non-production system and replaces it with random data. Libelle provides a specific implementation for Data Masking with its very own Libelle **Data***Masking* solution as outlined later in this Whitepaper.

#### Smoke Testing Phase

Customers often have individual checks before releasing the systems to validate that the process was completed successfully. This could be execution of automated reports, or taking random samples of specific T-Codes. Many Smoke Testing tasks can be automated as part the workflow

Core Refresh Phases are: Pre-Processing covering mostly configuration table exports, a full database copy, followed by post-processing including imports, BDLS, and other post-steps.

# Setup and Operate Libelle **System**Copy

Libelle **System***Copy* (LSC) is delivered to the customer as perpetual software license or monthly subscription. The software runs under full control of the customer. All operations and executions are contained inside the customers network with no outside connections required. Additional LSC worker agents are installed on systems that are participating in the refresh as required. After configuring SAP and database connections, a workflow editor provides a standard refresh template for the specific environment and refresh steps are adjusted or expanded needed. After the template is activated, refresh execution is conveniently monitored and managed through the LSC GUI.

#### Setup Libelle Automation Framework

LSC is based on a powerful automation framework. It runs on an LSC Master Servers to centrally manage configurations, distributed LSC Worker Agents and refresh Executions. Both LSC Master and Workers are easy to install as a Server Agent Installation. Installations can be cascaded by simply copying the installation directory to a new server and making adjustments. Once installed, Workers can be updated to the newest version from the Master. Installing LSC Master, setting up Workers, and configuring the workflow is a matter of a few hours. LSC typically does not require SAP Transports to be applied to the SAP systems.



LSC runs on a separate server and 'lives outside' the SAP systems that are refreshed; this dramatically simplifies operation and management of refreshes.

LSC was designed with security in mind. LSC users can be managed locally, or users can be completely externally authenticated and authorized via Active Directory or LDAPS. Public/ Private Key combinations protect passwords, and digitally signed configuration files ensure that formal user identification can be bypassed to manipulate configurations. Key components of the LSC Automation Framework include:

- LSC Master Server installation(s) on a standalone Linux, Unix, or Windows Server; additional Worker installation(s) on the systems where refresh steps are executed; Libelle Connectors to communicate with/between SAP Systems, database, and servers.
- LSC Task Repository including nearly 500 pre-configured tasks, workflow orchestration and workflow management engine.
- LSC role-based GUI(s) for refresh configuration, refresh management, and refresh execution.

LSC Tasks fall into the following categories. They can be either LSC Standard Tasks from the Libelle Repository, tasks developed by customer, or custom tasks built by Libelle for a specific customer.

- Tasks for SAP Tables and Database Operations: R3Trans Exports/ Deletes/ Imports, SQL Connectors for SAP HANA, SAP ASE, SAP MaxDB, Oracle, DB2, and MS SQL Server.
- Tasks for Unix, Linux, and Windows Script Executions: Shell Script Executor, PowerShell Executor, Libelle Shell Executor, and others.
- **Tasks to execute SAP Functions:** Generic R3Trans Tasks, execution of ABAP programs via SAP's standard SDK, or execution of SAP executables or Reports.
- Tasks to manage Refresh Workflow: Manual breakpoints, multi-system synchronization tasks, and Email Status Tasks.



Figure 3 – LSC Architecture Overview



### Setup SAP Configuration in LSC

After installing the LSC Master Server, basic settings for each required system are configured. LSC supports multi-system configurations to support installation where for example a standalone Database Hosts runs separately from the Central Service Server. Configurations can be easily duplicated via the LSC GUI. All configuration data is stored on the Master Server. Connections to the SAP system are made via the Standard SAP SDK. Only requirement inside SAP, is to setup a Libelle SAP user on the system that needs to be refreshed with defined authorizations for refresh tasks. Below a screenshot from an LSC GUI defining the SAP configuration of a QAS Central Services System.

S4H_SQ1						Change State: 41
General						
Systems 🔓	🔶 🜠 Sys	stem Identifier: SQ1				
Copy Tool		lagelbast				
Data Masking	nost warne:	localitost				
Categories	Description:					
Tasks	JRE Home Directory.	0500		1		
Global Parameters	ore onset.	-0300				
Sninnete	System Roles					
:	Source SAP	Source Datab	ase Targe	et SAP	Target Database	Satellite System
Execution			(	✓	<ul><li>✓</li></ul>	
Alarm	SAD Data					
Authorizations	Sustam Tures	FCC				;
	Basis Release 6	750	¥	Support Stack	04	
	System Name:	SQ1		Instance Numbe	r: 00	
	User Name <sid>adm: 6</sid>	sq1adm				
	Password <sid>adm: 1</sid>	•••••				
	License Type:	New				
	Java Instance Home:					
	Profile File:	/usr/sap/SQ1/SYS/pro	file/SQ1_DVEBMGS00_s	cosapt1		
	Client	User Name	Password	Logical System Name	е Сору	Default
	000 li	ibelle	•••••		~	0
	200	ibelle	•••••	SQ1CLNT200	✓	•
			New	Remove		
	Database Data					
	Туре:	HANA				
	Database Name:	SQ1				
	Instance: 👔	00				
	Home Directory: 🕕	/hana/shared/SQ1/HD	800			
	Port: 🚯	30041				
	User Name:	system				
	Password:	•••••				
	ABAP Stack					
	Schema Owner:	SAPABAP1				
	Schema Password:	•••••				
	Java Stack					
	Schema User:					
	Schema Password:					
						Save Cancel

Figure 4 – Introduce SAP System Configuration to LSC



### Refresh Template Management

In addition to providing a powerful workflow editor for setting up individual refresh configurations, LSC provides an easy-to-use Template Engine so that customers can define their own standard refresh templates.

All configured Refresh Configuration are available as Template Configuration. Changes in configurations can be easily updated in the respective template and are then available to derive refresh configuration for future refreshes.

Instead of editing each and every single configuration, customers can make workflow edits in the template for their refresh type such as ECC. Individual workflow configurations such as refresh for QA2 are then derived from the template to make them consistent with other QA refreshes for that system type. Also, workflows as well as templates have a detailed change log so each and every workflow change can be traced down to date, time, and LSC user.





#### Troubleshoot Refresh Issues

Sometimes, certain steps during a refresh may result in an error state. This could be due a configuration error, change in landscape, or any other issue. As LSC follows standard SAP transactions, standard log files are returned and presented for analysis. LSC provides access to logs via the LSC GUI. Administrator can immediately determine root causes, apply fixes and resume from the failed step.



Figure 6 – Troubleshoot Refresh Issues

#### Manage Development Refreshes

Libelle developed and implemented various workflows and tasks to support the automation of System Refreshes for development systems (DEV Refreshes). DEV Refreshes can be executed either as Homogeneous System Copy or as local or Remote Client Copy. Either scenario is supported by LSC. Libelle's task repository for DEV Refreshes includes the exports of all versioning and repository object related tables, development user and access keys, variant-related tables, custom client-dependent tables, and more. A process around releasing open development projects is implemented jointly with the Libelle implementation team, and transports for the same are created. These open development projects are reimported into the system as part of post-activity to get all open development back into the system along with version and repository tables.

### Self-Documentation and Self-Reporting

With manual refreshes, Customers typically maintain documents with hundreds of pages to describe an organizations' refresh process. LSC is self-documenting and an organizations' Standard Refresh Guide is fully reflected with the software. All and any steps in the workflow are fully documented. Each executed refresh produces automatically a neatly organized PDF report with all and any steps that were executed, run times, exceptions, and all and any log files. A typical production refresh execution report can have 500+ pages considering all log files. Changes to the workflow are traced to the user that made changes via LSC change reports.



# Refresh Workflow and LSC Task Repository

LSC comes with an extensive set of nearly 500 pre-configured refresh tasks. Each single task has been carefully designed, built and tested, and is maintained by Libelle on an ongoing basis. New SAP releases might require task updates as additional tables are added. Libelle is pro-actively maintaining the tasks and updates ahead of time. Libelle also actively seeks feedback from existing customers on their refresh experience and incorporates new tasks as possible.

#### Anatomy of LSC Refresh Tasks

The following table shows the anatomy of a single LSC task of the which is part of the workflow of suspending batch jobs in pre-processing. Libelle repository provides a workflow to suspend batch jobs temporarily before exporting them during pre-processing, so that they continue to stay in suspend mode after they are re-imported in post-processing. The task below is meant to illustrate the anatomy of refresh tasks, there are more tasks related to batch jobs in post-processing not listed.

Libelle Task	SM37: Suspend Batch Job
Description	Execute SAP Report BTCTRNS1 to suspend batch Jobs
Phase	Pre-Processing
Sequence in Phase	#11
Execution Location	Target SAP
Task Type	ABAP Program
Active	Yes
Input Parameters	report_name = BTCTRNS1, variant = NULL
Return Codes	Ok, Warning, or Error
Client Dependency	Run on Default Client
LSC UID and Version	LBTJBUSP (Version 9.0)

Table 1 – Anatomy of an LSC Refresh Task

Each Libelle Tasks can be activated or de-activated by a simple mouse-click via the LSC GUI. Tasks can also be activated as a group depending on the system- or implementation type is being refreshed. Such task groups may include BI-specific tasks, LiveCache-specific tasks for SCM systems, etc.



### LSC Refresh Task Types

The LSC Task Repository can be classified into four categories:

- 1. Standard Pre-Processing Tasks: Includes the export and management of the 50-70 T-Codes or areas containing mostly configuration data. It also includes the system stop sequences for SAP Landscapes
- 2. Standard Database Copy Tasks: DB Copy Automation tasks for SAP HANA, SAP ASE, SAP MaxDB, Oracle, DB2, MS SQL Server. Copy tasks come as a variety of copy options from automated backup-restore, restore-only, database snapshots, or online copy from Production or other systems.
- **3.** Standard Post-Processing Tasks: Includes the import and management of configuration tables exported in Pre-Processing. Other post-processing tasks includes logical system name conversions (BDLS), TemSe consistency checks, and system start sequences.
- 4. Module-Specific and Cross-Functional Tasks: Includes tasks specific to BI, SCM, LiveCache, CRM, and others which are not included in the standard Task Repository for NetWeaver for ECC; tasks for PI connections, CRM Middleware, RSA Admin tables, and SOA Manager; tasks for export/ import of JAVA stacks for dual-stack systems; tasks for managing Transport Deltas. Tasks for End User Messages and retention of Background Screens. System Copy or Client Copy Tasks for refreshing Development Systems.

#### Automation of Typical Refresh Tasks

The following is an overview of typical refresh tasks that are automated with LSC. This is not a complete list, but rather a selection of core steps taken.

Area	Description
Manage Transports	Refreshes require handling of pending transports in QAS systems. LSC has pre-configured tasks to export the transport request tables, creating a list of delta transports, and either imports them automatically in post- processing, or creates a list that can be validated manually by the customer prior to releasing them into the refreshed system.
Manage Batch Processing	During the refresh, Batch jobs need to be handled properly. LSC has pre- configured tasks to put batch job in suspend mode on QAS, export them in suspend state and re-import them in post-processing in suspend state.
Retain Logon Screens	Non-Production systems typically have logon screens that differ from production to indicate the type and nature of this system. LSC retains the logon screens as part of the refresh.
Broadcast SAP Messages	Users will need to log-off QAS prior to the refresh. LSC provides tasks to broadcast customizable messages inside SAP prior to the refresh.
SAP Stop and Start Sequences	During refresh, QAS will be shut down and started during post-processing. This requires a specific sequence of steps which are included with LSC.

Retain RFCs, Profiles, Users, Printers	RFCs, Profiles, Users, and Printers will be copied from Production during the refresh. LSC provides tasks to export all relevant tables during pre- processing, and re-import them in post-processing to retain settings.
Export and Import JAVA stack	For dual-stack systems, LSC provides tasks to export the JAVA settings on the file level in pre-processing, and import them in post-processing.
Central User Administration	If SAP users are administrated centrally, LSC has tasks to export all of the configuration necessary for CUA (Central user administration) and import them back after database copy into the target system.
Manage SAP Licenses	Specific tasks in LSC take care of SAP licenses including 'old' and 'new' formats of SAP licenses.
Retain SecStore Settings	SAP stores encrypted data required by the Application when logging on to other systems. The encrypted storage (SecStore) prevents unauthorized persons or programs to access this data. LSC tasks export and import SecStore related tables during the refresh.

Table 2 – Automating typical refresh Tasks

### Database Copy Automation

The database copy phase is executed following the pre-processing phase which revolved mostly around exporting configuration tables, and prior to LSC post-processing which covers all configuration table imports and post-steps such as BDLS. Libelle provides a variety of database copy tools, pre-configured workflows, repository tasks, and snapshot integration tasks to fully automate the database copy phase. Libelle supports all database platforms supported by SAP including SAP ASE, SAP MaxDB, SAP HANA, Oracle, DB2, and MS SQL Server.

LSC provides a pre-configured automated database copy via backup/ restore, database snapshots, or integrate customer scripts into the refresh workflow. It is also very simple to combine existing LSC tasks with custom requirements.

Roughly speaking, the database copy is executed in three database-specific phases: database pre-copy, database copy, and database post-copy. A specific implementation of the copy workflow, is Libelle's Snapshot Integration that is available for common snapshot tools, and popular cloud platforms such as AWS, Azure, and GCP. An example of this integration is outlined in the SAP HANA section of this Whitepaper.

### Accelerate Logical System Name Conversions (BDLS)

The SAP transaction BDLS is executed after a System Refresh or Client Copy. BDLS converts logical system names that came from production with the database copy into the logical system names of the new target system. If there are multiple connected systems, multiple conversions are done. Runtime for a non-optimized BDLS execution can range from hours to a few days.



Executing logical System Name Conversations (BDLS) can take many hours, or even days. Libelle's BDLS implementation drastically accelerates BDLS and customers can expect a 50% improvement, though even often reduce run-time by factors 3-5.

Libelle's latest BDLS iteration brings massive performance improvements. Customer simply provide BDLS parameter such as the individual threshold for large tables, and system names during configuration of the workflow or workflow template: A highly optimized algorithm as outlined below delivers a highly accelerated execution. Paired with a fast-performing database such as SAP HANA, BDLS is no longer the bottleneck of a refresh.

LSC's BDLS Phase	Tasks Executed
Identify	Inventory of required conversions; identifies approximately 1,800 BDLS conversion tables
Prepare	Define threshold for large tables (e.g. >500k rows), identify large tables, execute standard BDLS on small tables, and handover large tables for LSC bulk-update algorithm.
Index	Create database indexes for identified large tables and drop secondary indexes.
Update	Run optimized BDLS for large tables with updates in parallel across/ within large tables.
Cleanup	Drop BDLS Indexes and rebuild secondary indexes.

Table 3 – Steps for Accelerated BDLS Execution

# Refreshing SAP HANA with LSC

Since SAP released the very first version of SAP HANA, Libelle has been diligently adopting and expanding LSC to support refreshes for SAP HANA. LSC has been successfully supporting countless customers migrating their refresh workflows to Suite on HANA and S/4 HANA. Over the years of executing refreshes for SAP HANA, we gained valuable insights and best practices for the latest platform and include many of them in this chapter. This chapter covers both Suite on HANA and S/4 HANA refreshes.

### SAP HANA versus Legacy Refreshes: Key Points

From a technical perspective – and except for managing the database copy during the Refresh Copy Phase – the refresh workflow for SAP HANA does not fundamentally differ from refresh workflows for legacy systems. Suite on HANA and S/4 HANA are fully running on the SAP NetWeaver platform and thus most steps for a refresh are identical. However, there are a few exceptions and best-practices to follow as outlined in here. Not all SAP HANA related steps are covered in this Whitepaper.



Compared to Legacy SAP Platforms and except for the database copy phase, the vast majority of the workflow of Legacy Refreshes versus SAP HANA is identical. Most of the changes are driven by newly available tools and covering a few additional new objects.

#### SAP HANA means higher Grade of Standardization

SAP HANA means highly standardized SAP operation. For decades, SAP supported a large number of operating systems and databases. This was opening up opportunities, but also meant a fragmentation where almost no single SAP installation was matching another. Each SAP installation was unique starting with a combination of Operating System and Database platform and a myriad of different landscape management options such as system management, backup tools, and more.

With SAP HANA, systems are installed and operated very uniformly. Solutions such as LSC can now provide even more standardized workflows that suits the vast majority of customers. Result is a more uniform, faster, and highly orchestrated process.

#### Simplified Database Handling with SAP HANA

Overall, SAP HANA is simple to operate and manage compared to legacy platforms. Besides providing the key concepts of in-memory storage and a column-oriented DBMS, SAP consequently incorporated best practices when SAP HANA was designed and built. SAP has nearly three decades of working with different database technologies and with SAP MaxDB and SAP ASE actively developed its own DBMS for years. This results in noticeable simpler database handling with less moving pieces that have to be taken in consideration.

In context of system refreshes, the backup, restore, and database snapshot commands required for a database copy are straight-forward, easy to execute, thus easy to automate and incorporate in an end-to-end automated workflow. HANA DB backup and restore executes very fast from the internal algorithms, and are further accelerated by powerful hardware, storage, I/O bandwidth, and the fact that HANA DBs are generally smaller in size than legacy databases.

#### Potential for Speed

SAP HANA runs on very powerful hardware in terms of available I/O, storage, memory, and number of CPUs. Even an unoptimized or only semi-automated system refresh workflow will see reasonable improvements in execution times. Still, hardware alone cannot fix inefficient algorithms. An example is the sequential execution of BDLS of large table. Libelle has been optimizing refresh workflows for years to overcome hardware limitations, ad worked in extreme requirements such as updating tables with hundreds of millions of rows for BDLS conversions.

Libelle **System***Copy* feeds powerful algorithms to powerful hardware reducing end-to-end refresh execution times to hours from days.



### SAP HANA – Database Copy Automation

The database copy phase in the context of System Refreshes is the process of orchestrating a full database copy as outlined generically in a previous section. This section outlines the specifics of HANA database copy automation which can be achieved by automating database backup/ restore commands or by using HANA DB snapshots. Either scenario is fully supported by LSC.

HANA DB Backup and Restore executes very fast due to the availability of powerful hardware, and fairly efficient algorithms. Additional speed can be achieved by utilizing HANA DB Snapshots.

#### Copy Automation via Backup and Restore

One fairly simple option to copy the HANA DB is to automate the backup and restore process. Besides full backup/ restore, SAP HANA supports point-in-time recovery via Log Backups, Incremental Backups, and Differential Backups. However, since refreshes provide a past version of the database, Libelle generally sees customer requirements allowing for a simple full restore. LSC provides automated pre-configured database copy tasks that are managing either the full lifecycle of database backup, copying the backup files to the QAS system, and managing the restore; or LSC can start anywhere in the middle of the lifecycle by restoring a backup that was previously created and made available to the QAS system.

#### Copy Automation via Database Snapshots

HANA DB Snapshots are a pre-defined workflow provided by SAP to put the database in a consistent state, so that a Snapshot on Disk Level can be triggered. Result is the provisioning of a database copy in minutes instead of hours. Please be aware of the fact that as late 2018, SAP only supports snapshots for single-tenant database configurations where there is only one tenant with the system database present.

Please use caution when planning for HANA DB snapshots in multi-tenant setups, as support from SAP for snapshots might be limited when multiple tenant databases are present.

The following is an example of how Libelle automates HANA DB Snapshots in combination a storage snapshot backup.





Figure 7 – HANA DB Snapshots

#### Refresh SAP HANA – Other Areas

As outlined in the introduction, the majority of refresh steps are identical between legacy systems and SAP installations based on SAP HANA. This is due to the fact that both Suite on HANA and S/4 HANA are fully based on the latest NetWeaver stack. However, as SAP continuous to introduce new tools and incorporates new functionality, there are a few areas that offer additional potential for automation. Libelle closely monitors and tests the newest releases available from SAP and actively seeks customer inputs. Here a few topics identified and covered as of late 2018.

#### Manage HANA DB Schema Users

The HANA DB Schema User has roles assigned with privileges to accomplish certain tasks. The Schema Credentials (User/Password) on Production are different than those on QAS. With the database copy, the QAS Schema User Credentials are overwritten with Production settings. LSC takes care of Schema Users with a dedicated task that resets the passwords back to their original QAS values.

#### Manage HANA DB Admin Users

Similar to the Schema User, HANA DB Admin User Credentials are coming from Production and original users are ultimately lost with the database copy. This causes manual work to re-create Users and Roles. As of late 2018, LSC provides a semi-automated process to recreate the users. Some of the tasks related to re-create users are automated, with some manual post-steps required by the Administrator.



#### Manage HANA DB Cockpit Settings

With HANA DB, SAP released the HANA COCKPIT which is based on SAP Fiori Launchpad Accessed by XS Engine via a Browser. There is an overlap in functionality with the Eclipse-based HANA Studio. Since HANA Cockpit is browser-based, there is a good chance that SAP moves more functionality into the HANA Cockpit. As of late 2018, Libelle released the first tasks to handle HANA DB Cockpit settings. Similar to HANA DB Admin User, some tasks are automated with a few manual post-steps required. Please reach out to Libelle for details.

#### Manage S/4 HANA Refreshes - Observations

S/4 HANA is the next generation business application platform that takes extensive advantage of the new underlying HANA-based technology platform. There are significant differences in S/4 in regards to business transformation, business logic, and new features that take advantage of the near real-time processing made available by the in-memory operating, and column-based database design. However, as outlined earlier, from an SAP Basis Perspective, the underlying technology is still the SAP NetWeaver platform that has been standardized years before.

S/4 HANA is based on SAP NetWeaver. Therefore, and except for database handling, System Refreshes generally follow the same workflow as Suite on HANA and Legacy Systems .

A few observations we saw in our day-to-day practice and incorporated in our workflows:

- S/4 HANA typically comes with an SAP FIORI frontend installation. For refreshes, this will require a regular refresh for SAP Fiori as well. SAP Fiori is a standard NetWeaver ABAP refresh. We saw requirements for refresh steps to be coordinated between S/4 HANA Backend and SAP Fiori Frontend and implemented these steps at various customers. A newer approach is to utilize SAP Tasklists to achieve the same and LSC can trigger Tasklists if they are available.
- Client Copies for S/4 HANA require specific performance settings and parametrization. LSC has a pre-configured workflow incorporated for the recommended export parameters, configurations for skipping empty tables, and SAP notes for parallel execution. This largely also applies to Suite on HANA.
- Except for greenfield installations, the transformation to S/4 is primarily focused on the business side. It is the one opportunity to consolidate into a single platform and heavily business-process dominated. With that, system refreshes are often a side-topic up to the point of moving into operation. Once in operation it again becomes again a center topic.
- Libelle expects that there are continue to be requirements and new tables that are added with the S/4 platform in the future and incorporates them in the LSC Task Repository that is continuously updated and fully available to subscription customers or customers under maintenance.

When executing Client Copies for SAP HANA, specific performance settings are required which are fully pre-configured with LSC.



# Data Masking

Libelle provides a specific solution called Libelle **Data***Masking* (LDM) which obfuscates (anonymizes) sensitive data in non-production systems after the System Refresh is completed. This is achieved by physically replacing defined sensitive data with random data. With that, customers can sanitize their development or QAS systems from anything that is deemed too sensitive for a wide range of developer to access freely. LDM replaces sensitive data with random data from the LDM reference database or data that is randomly generated at runtime. LDM ensures that data remains usable by intelligent preconfigured algorithms. LDM also takes into consideration the referential integrity of data to ensure that masking is executed across consistently across the database and even across different databases.

With Libelle **Data***Masking*, Libelle provides a fully integrated Data Obfuscation Solution. Result is an automated system refresh followed by an automated data sanitation workflow.

Below some of the key features and functionalities of Libelle **Data***Masking*. Please refer to the respective LDM Whitepapers for more information and reach out to Libelle for more information

- LDM replaces original data in non-production systems with random data; Sensitive data is fully protected as it is completely removed.
- Data remains fully usable with all characteristics such as made-up real names, retained character encodings, retain patterns such as account numbers, etc.
- LDM provides pre-configured Masking Profiles such as names fields, fields for account numbers, country-specific addresses and locations, etc.
- LDM provides pre-configured Masking Algorithms such as replacing names with made-up Libelle names from a reference database, shifting date of birth within limited ranges, or credit cards with valid check digits.
- LDM utilizes the SAP Data Dictionary to support customers identifying sensitive fields.
- Upon Masking Execution, Customer provides a unique Masking Key (e.g. Passphrase). Masking Key ensures consistent application of masking algorithms. Same input with same Masking Key produces same output. This provides referential integrity of the data model without ability to reverse masking.

Data Masking can be expensive in terms of execution time. Some SAP tables may contain hundreds of millions of rows with data; an update job almost impossible to complete in a reasonable amount of time if updated sequentially; sequential updates cannot take advantage of multiple CPUs available in large SAP HANA systems. LDM is built to cover such requirements in high-speed due to a groundbreaking update algorithm. LDM splits updates into multiple processes which allows massive parallelization and utilization of many CPUs at the same time.

Finally – Libelle **System***Copy* has a preconfigured interface that allows the simple integration of the masking process into the post-processing face. As masking is done on a database level, it can even be done prior executing a refresh on a separate server with a database copy prepared ahead of time.

Libelle **Data***Masking* splits updates of large tables into multiple sub-processes, which allowing for fast execution time of massive tables with hundreds of millions of rows.



# LSC Specifications and Key Features

### **Specifications**

- Supported Scenarios: Homogeneous System Copies, Local/ Remote Client Copies
- Supported SAP Systems: Any SAP NetWeaver >7.0; Prior versions with custom repository
- Supported Platforms: Linux, Windows, UNIX
- Supported Databases: SAP HANA, SAP ASE, SAP MaxDB, Oracle, DB2, MS SQL Server
- Refresh Task Repository: Nearly 500 pre-configured tasks
- Architecture: Central Master Server with worker agents
- Supported Task Types: R3Trans Export/Delete/Import, Shell Scripts, ABAP executions, etc.

#### Key Features

- Complete Refresh: Covers thoroughly all aspects of SAP pre-processing (e.g. exports), complete database copy (e.g. snapshots or backup/ restore), and SAP post-processing (e.g. imports, BDLS, TemSe).
- Independent: Runs on a separate EC2 instance without requirement to make any changes to existing SAP landscape or apply transports. Task executions are worker-agent based using Libelle Connectors.
- Powerful Connectors: Generic connectors to execute R3Trans (Table Export, Delete, Import), SQL programs (e.g. SAP HANA, SAP ASE, SAP MaxDB, Oracle, etc.), ABAP executors, Shell Script executors, and many more.
- Complete Repository: Covers nearly 50-70 T-Codes required for refreshes, cross-functional tasks such as transport delta management or SOA Manager, and application-specific tasks such as tasks specific to BI, LiveCache, or CRM Middleware configurations.
- Simple to implement and simple to use: Up and running in as little as three days for a standard NetWeaver system.

#### Key Benefits

- Standardization Automation forces standardization
- Acceleration –Refreshes delivered faster
- Predictability and Consistency Provide predictable and consistent refreshes
- Traceability Each refresh step is documented in detail
- Simplicity LSC is an automation tool running 'outside' SAP; does not require changes to landscape
- Resource Optimization Do more with less
- Risk Reduction Reduce risks of errors compared to manual refreshes



# About Libelle

Libelle is a software solution provider with its U.S. headquarters based in Atlanta Georgia. The company was founded in 1994 with its worldwide headquarters in Stuttgart Germany. Libelle's solution portfolio includes three main divisions: (1) Complete Data Replication with Libelle BusinessShadow for Oracle, DB2, MS SQL Server, SAP HANA<sup>®</sup>, SAP MaxDB, SAP ASE<sup>®</sup> and File Replication; (2) System Refresh Automation for SAP<sup>®</sup> Systems with Libelle **System***Copy* including add-ons to facilitate Client Refreshes and System Clones, Database Copy Automation, Data Obfuscation automation; (3) Enterprise Data Obfuscation with Libelle **Data***Masking*. Libelle has more than 500 customers across all products worldwide with its solutions installed over 2,000 times combined. Thereof, Libelle **System***Copy* is installed at 250+ customers with thousands of known refresh configurations.

Approximately 80% of Libelle's customers are SAP<sup>®</sup> Customers, and solutions are implemented in the context of the SAP<sup>®</sup> ecosystem. Libelle has been an SAP<sup>®</sup> Partner since 2005 and maintains senior and/or gold partner levels with global player in the industry. As of 2016, an estimated 40% of Libelle Customers are public companies, including more than 80 customers with \$1bn+ annual revenue.

# Why Libelle for System Refreshes?

Below a few points for consideration when choosing a solution for system refreshes.

- **One-stop Solution** One single solution for System Refreshes, System Clones, Client Copies, and Data Masking
- **Refresh Experience** Libelle has been delivering this refresh solution successfully to customers worldwide since 2011. More than 250 customers run LSC today with thousands of known LSC refresh configurations supporting automated refreshes on an ongoing basis. Libelle has been developing Enterprise Software for more than 25 years and our LSC Development Team is designed to work agile, which provides new enhancements continuously.
- Task Repository and Task Updates Libelle provides a pre-configured workflow, and not a collection of scripts. Libelle pre-configured tasks are carefully designed, engineered, documented with input and output parameters, versioned, regularly updated with Libelle updates, and deployed as standard tasks. Other vendors may not provide standard tasks, or may provide shell scripts that have been used at another customer and leave the new customer with maintaining scripts. We know from talking to customers using tools from other vendor that once that implementation is completed, scripts must be 100% maintained by customer afterwards.
- **Refresh Workflow included** LSC Automation Software including Refresh Tasks instead of Automation Software Only. Libelle provides both (1) an extensive and easy-to-use Automation Framework, and (2) an industry-leading Standard Repository for the workflow required. Other vendors may only provide an Automation Framework, but leave the development of the workflow to the customer. Libelle provides both.
- Highly Flexible Libelle runs 'outside' SAP providing support for tasks running inside and outside SAP if SAP is not running. Libelle supports tasks including (1) R3 Trans Task, (2) Exports/ Imports, (3) Database SQL tasks, (4) ABAP programs, (5) running reports, (6) shell scripts (CMD, PowerShell, Linux/Unix Shells, Libelle Shell), and (7) interactive tasks (manual breakpoints for customer to



start/ stop/ divert workflow). There is no requirement to load transports into SAP, or make any changes to the SAP landscape.

- Automated Database Copy Libelle is likely the only vendor to includes a standard software solution to automate the Database Backup/ Restore/ Rename (DBShadow tool) based on the Libelle software which replicates databases including renaming. It includes an end-to-end database copy phase with the option to split up the Backup and the Restore phases. Also, the automated database copy will be fully integrated into the LSC workflow and framework as part of implementation. Other vendors may only provide options to develop scripts for the workflow.
- **Optimized BDLS** Libelle provides a highly optimized BDLS implementation as part of the standard repository.

Libelle sees its own LSC solution as market leader in terms of completeness of its task repository, performance, maturity, and simplicity.

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