

Advanced Automation and Optimization of System and Landscape Copy Procedures for SAP® Applications with Libelle SystemCopy



SAP® application environments include Quality Assurance (QA), Test, and other Staging Systems in addition to actual Production Systems. For proper and consistent testing and the approval of changes that have been made in programs and processes, SAP recommends a specific procedure called “homogenous system copy”. The process is also used to provide non-production systems with the latest production data.¹

Typically, there are numerous manual tasks involved for executing the system copy procedure, which can drag on for hours or even days. If you are working with environments of multiple connected systems, the runtimes for those landscape copies add up to painfully long downtimes. There won’t be a “right time”.

Alongside the unavailability of the target systems, for the operating and project teams, the system and landscape copies block additional important and expensive resources: internal or external SAP Basis Professionals.

Libelle **SystemCopy** is a framework-based software solution to create fully automated system and landscape copies. With the proverbial touch of a button QA and test systems get updated with fresh production data. Libelle **SystemCopy** supports all conventional databases and operating systems, provides its own copy mechanisms for all platforms, but at the same time integrates backup/restore procedures or storage tools. The activities that are necessary during a system copy are controlled from outside the ABAP®-Stack. This way no transports or other changes are required in the SAP applications.

This white paper describes the process of automated and optimized execution of homogeneous SAP system copies with Libelle **SystemCopy**.

¹ SAP Help Files (Link)



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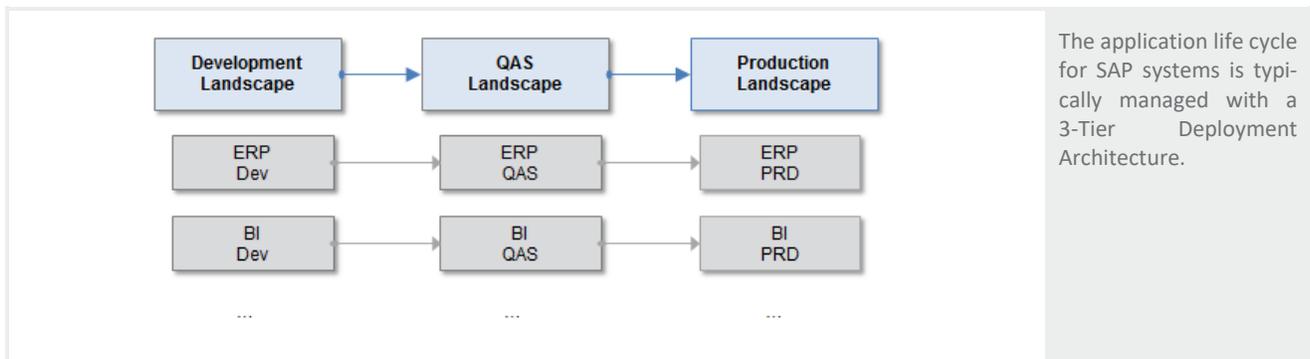
SAP® Application Life Cycle, System and Landscape Copies

SAP SE provides an organizational model to help companies with a holistic and integrated ITIL-based approach for managing the lifecycle of SAP applications.¹

Customers typically implement a 3-tier deployment architecture, comprised of:

- (a) development or test systems (DEV) where applications are developed and tested,
- (b) quality assurance systems (QA) also commonly referred to as staging systems, where final testing takes place
- (c) production systems where SAP users do the operative work

Customers may also have additional nonproduction systems such as training or “sandbox” systems.



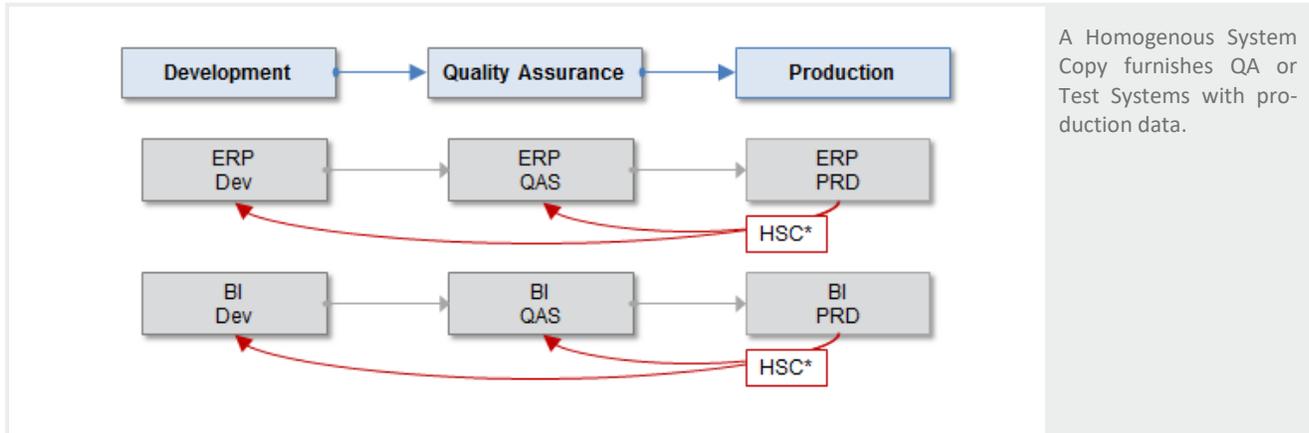
The application life cycle for SAP systems is typically managed with a 3-Tier Deployment Architecture.

Depending on the distribution and complexity of the entrepreneurial tasks, the SAP landscape of a company may be more complex than the straight line pictured above, containing only one development, QAS and production system respectively. Most landscapes consist of multiple, often codependent, applications and environments.

The execution of periodic system copies is already critical on its own, because an adequate simulation for coherent and consistent testing and staging procedures, is only possible with current data.

Additionally, when dealing with complex structures and interrelated environments, it is necessary to be able to update complete landscapes consistently, as to test business processes end-to-end.

¹ SAP Developer Network (Link)



System and landscape copies get executed in relation to the demands of the customer, his departments and his internal test and clearance standards. The frequency can vary from yearly, to monthly or even more frequent during critical project phases.

After a system or landscape copy, for example onto a QA system, unauthorized people might have access to sensitive data. Because of that, data anonymization is another important topic, which we will highlight in a later chapter.

Terminology

There is consistent terminology in the various system copy guides that SAP SE provides:¹

- **System copy:** Duplication of SAP systems; certain SAP parameters change
- **Source system:** The SAP system containing the original production database
- **Target system:** The system to which the database copy is copied
- **Homogenous system copy:**² System copy to the same operating system and database platform as the Source system
- **Database copy:** Database-dependent part of the system copy

¹ E.g. "System Copy for SAP Systems based on SAP NetWeaver 7.1 Java," December 2009, [link](#)

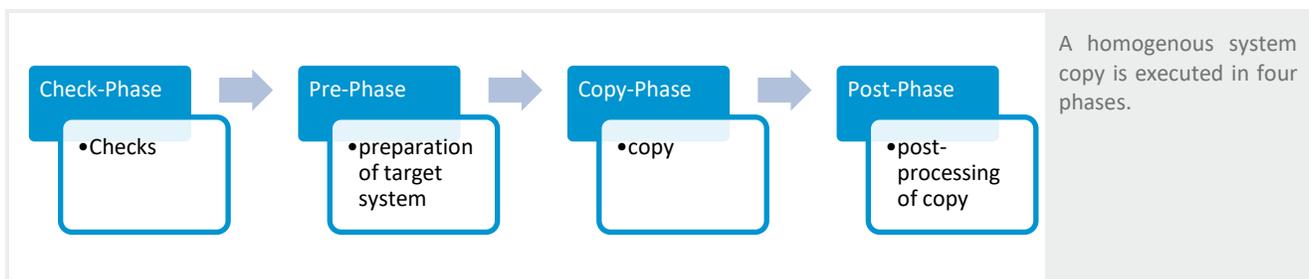
² SAP also lists a Heterogeneous System Copy procedure where the database or O/S platform changes. This is currently not covered in the Libelle *SystemCopy* procedure and is not part of this white paper.

The Phases of a Homogeneous System Copy

Generally, all steps necessary to successfully complete a system copy procedure can be categorized into four steps:

1. **Check-Phase:** Check of the involved system environments
2. **Pre-Phase:** Preparing the target system for a system copy
3. **Copy-Phase:** Providing a copy of the actual production database to the target system from the source
4. **Post-Phase:** All tasks after the copy to complete the homogeneous system copy procedure and to provide an updated target system

Knowledge and observance of these four steps is critical for classifying and automating the task details that are important for a homogenous system copy.



1.1 Check-Phase

Before the start of the system copy in the proper sense, it is ensured that certain prerequisites are met. The checks validate system and disk space availability, match versions between the source and the target system, verify compatibility of parameters, etc. Especially if the procedure is automated later and is scheduled to run overnight, we don't want to find that missing system permissions, disk space, or SAP license prevented us from completing the procedure.

1.2 Pre-Phase

The pre-phase of the system copy procedure prepares the target system to receive current production data. As the complete target database is overwritten with fresh production data, certain information from the target system must be saved ahead of time for later use. This mostly includes exporting various application specific tables, log-on groups, admin tables, Remote Function Call (RFC) settings, development user tables, and much more. For usage of the Java stack, we need additional configuration files.

On the target system it may also be necessary to stop scheduler, backup jobs, or anything similar, as not to interfere or interrupt the refresh process. The last task of the pre-processing procedure is to stop the active SAP components of the target system.

1.3 Copy-Phase

The copy-phase is replacing the complete target database (and flat files for dual-stack installations) with the source database and changes the name of the database (SID) because the QA target system runs under a different database SID, e.g., PR1 to QA1 (.)

There are various ways to execute the copy-phase. Storage snapshot tools and scripts, that are already in place could be used to copy and rename the database. Similarly, the Add-on Libelle **DBCOPY** can be used, which handles the copy-phase fully integrated via online copy.

1.4 Post-Phase

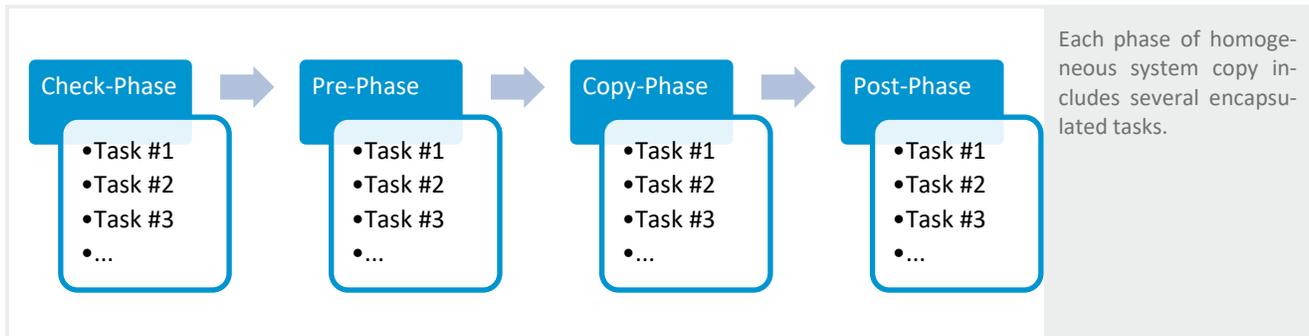
The last phase of the system copy procedure is by far the most complex since a large number of tasks have to be executed. While the database was already renamed in the copy-phase, there now is a need for additional changes to the database as well as its files. These changes include the adaptation of the preconfigured parameterization, as well as the activation of the information, that was saved during the pre-phase. Simultaneously, it has to be ensured, that the correct SAP license is utilized.

Some of the tasks will be generic for most SAP applications and some other tasks are specific to the SAP application and version. An SAP NetWeaver BW component for example, requires that the indexes are rebuilt; systems with Java stacks require additional imports or a reset of the configuration files. However, a common post-processing task for all systems is to rename all logical system names in the target system (running BDLS). This may take hours or even for days in larger systems.

After the successful completion of the post-phase, the homogeneous system copy is finished. The target QA system is now ready for the users - until the next refresh is due.

Tasks During a System/Landscape Copy

The very core of a homogeneous system copy is the execution of several standardized, as well as some system specific tasks, in a predefined order. For automation purposes, Libelle **SystemCopy** encapsulates and abstracts these steps into tasks that are assigned to the four phases described above:



Tasks are controlled sequentially or parallel, depending on the task type. Subsequent tasks depend on successful completion of previous tasks, which is tested through defined return values. The key to successful automation is to encapsulate system copy tasks according to SAP SE guidelines, internal necessities, and external best practices.

Later in this white paper, you will learn how the Libelle **SystemCopy** tool handles this procedure and by doing so follows the goal of complete automatization.

System/Landscape Copy Challenges

Most administrators or consultants experienced in executing the system copy process know that the procedure can be very lengthy and complex. A reason for that lies in the SAP environments themselves. The SAP application landscape evolved from the fairly simple ABAP-based SAP R/3® software to a highly sophisticated service-oriented architecture. With extended possibilities and a wide portfolio of applications, ranging from standard ERP up to dozens of specialized applications.

Additionally, a multitude of new technologies – like most recently the switch to HANA and S/4 – get integrated in the infrastructures. They might run on their own, parallel or even dependent on the conventional structures.

Especially with the enhanced possibilities and scalability of today's SAP environments, administrators face many challenges in managing the growing complexity.

Relating to this there are several **typical challenges** regarding homogeneous system copies and complete landscape copies:

- **Manual Procedure:** Many activities in the system/landscape copy procedure must be done manually by SAP basis administrators or consume the time and attention of highly trained expensive SAP specialists. Oftentimes this must be done on weekends or at night, as not to disturb the workflow.

- **Inconsistent Results:** Any manual procedure may vary in the way certain steps are completed or tables are updated. Some tables may not be updated at all. The result is a QA system that does not properly reflect the production system.
- **Large Number of SAP systems:** The increasing number of systems in a landscape leads to multiple copies per year for a single SAP system.
- **No Optimization:** Some tasks, such as BDLS, have the potential to be optimized by intelligent methods. As soon as a procedure is standardized and automated, optimization and performance enhancements can be realized with ease.
- **Testing without Current Data:** Because of the challenge, some customers may even capitulate and not update their QA systems at all. This results in a business risk as testing and staging are not done in actual production settings.

Automating and Optimizing System Copies with Libelle SystemCopy (LSC)

On paper and in practice, the necessary activities for system and landscape copies seem very complex. However, the individual activities for every SAP system in every SAP landscape are very similar and repeat themselves with each execution.

Because these activities can be neatly defined, controlled, executed and their results queried, they lend themselves to automation by software.

The Libelle SystemCopy Framework

Libelle **SystemCopy** is a framework-based software solution to create fully automated homogeneous system and landscape copies for SAP applications. Key aspects are, among others:

- Quick refresh of QA, DEV, or TEST systems with current production data
- Fully automated end-to-end process
- Fast turnaround and minimum manual intervention during the process
- Standardized procedures with consistent results
- No changes to existing SAP landscape necessary
- Quick amortization

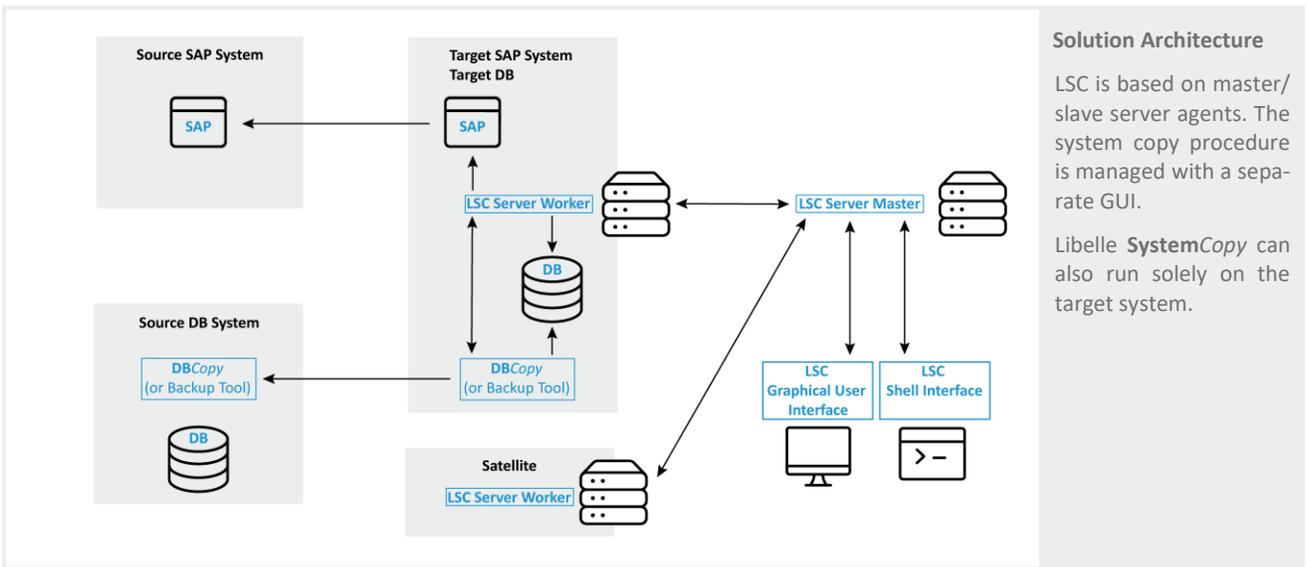
The Libelle **SystemCopy** software solution reduces the challenges and tedious work necessary required for a system/landscape copy to just two tasks: (1) start an automated process and (2) monitor the process. LSC is setup once, specific to the database, SAP instance, and SAP version. Afterwards it will execute the system copy procedure with consistent results, as many times as desired and with the flexibility to adapt to changing environments.

Already existing infrastructure methods, like storage snapshots and backup/restore, can be used for the physical copy process. Alternatively, Libelle’s own add-on Libelle **DBCop**y.

Libelle SystemCopy Architecture

To setup Libelle **SystemCopy**, a “master” server agent is installed on one arbitrary system of the customer’s system landscape. Multiple “worker” agents are installed on every system involved. There doesn’t necessarily need to be an agent installed on the source system, agents on the target system are sufficient. There is an exception to the rule however. If Libelle **DBCop**y is used for the copy-phase, there needs to be a server agent on the source system.

All agents are running directly on the servers, independently from the SAP instances. This enables them to execute the necessary tasks, whether they are to be executed within the SAP instance (ABAP programs, SAP transactions, etc.) or outside of the SAP instance (database export, shell scripts, etc.)



Solution Architecture

LSC is based on master/ slave server agents. The system copy procedure is managed with a separate GUI.

Libelle **SystemCopy** can also run solely on the target system.

In case of a landscape copy, the other systems involved are equipped with workers.

Depending on the complexity of the environments, different environments lend themselves to host the master process. For system copies this can be the target system. For landscape copies you might want to use the SolutionManager system or even an own server.

For the setup and the controlling of the LSC configuration you can either use the shell interface or the graphical user interface (GUI).



Graphical User Interface (GUI)

Configuring LSC and controlling the system copy can be done with the help of the GUI

Libelle SystemCopy Tasks

The phases of the system and landscape copy are mirrored in Libelle SystemCopy as encapsulated tasks. A task, e.g. exporting a table, includes:

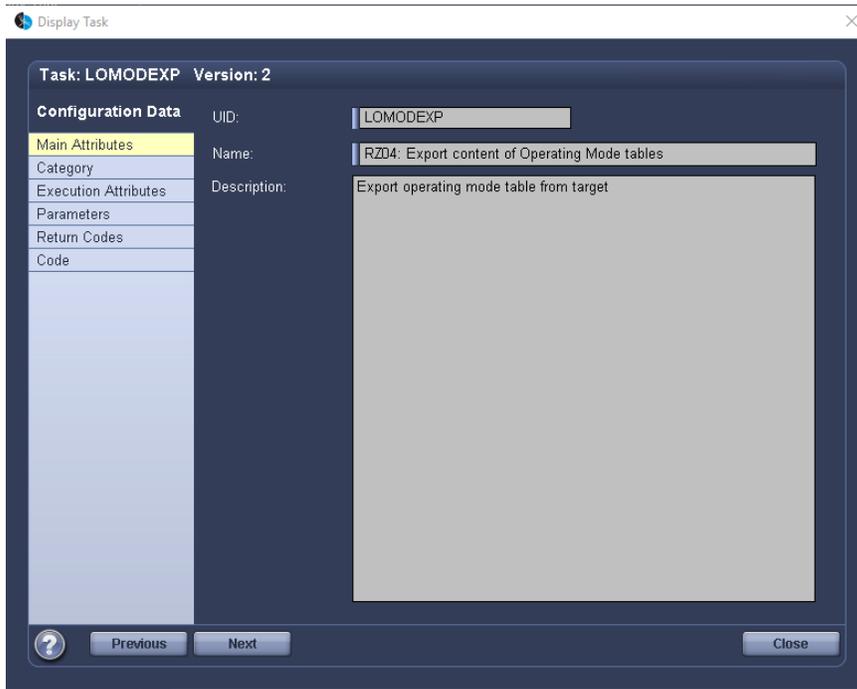
- (1) the actual export command
- (2) checking for successful execution
- (3) storing the export file on disk
- (4) processing the return signal which might indicate that the next step can be taken.

Additional check and log entries are written in parallel.

LSC supports the following task types:

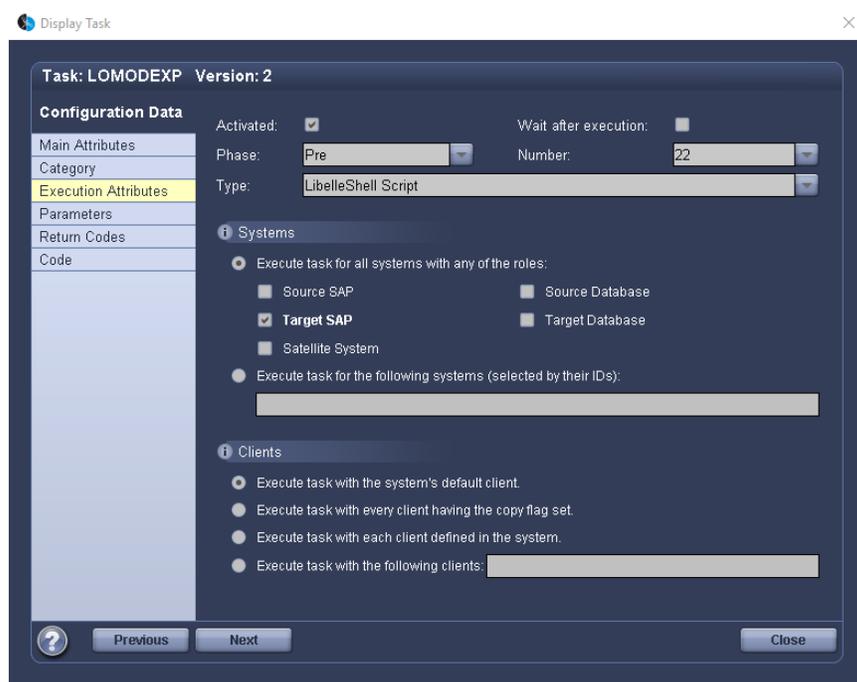
1. Executing SQL statements
2. Exporting or importing database tables
3. Running ABAP transactions
4. Running Windows® or UNIX® shell scripts
5. Executing Libelle’s own, LUA based scripting language, LibelleShell
6. Executing R3Trans actions and RFCs
7. Handling of synch points for parallel system/landscape copies
8. Break points, at which the administrator can execute activities manually

Each task is assigned to one of the four phases. Once configured, the tasks are stored in a configuration file and executed automatically according to the defined LSC procedure.



LSC Tasks

The tasks form self-contained activities of different types, that are executed on the appointed systems, at a certain point during the execution of LSC.





Libelle SystemCopy Configuration and Repository

Libelle provides an extensive repository of tasks based on wizards, to address the variety of SAP® applications, O/S platforms, database platforms, and SAP® application versions.

The selection, sequence, and configuration of tasks are planned together with a Libelle consultant. Most tasks are provided as out of the box “90% ready” templates for the respective standard system environments. Merely system specific task adjustments must be made on the customer’s system.

Each configuration is saved as a configuration file, that can be accessed by the LSC master during the system and landscape copy.

Executing the System/Landscape Copy

All that is left for the system copy procedure is starting the execution and monitoring the process. In accordance with the configuration, the tasks are distributed by the master among the workers. All results are handed back to the master, who in turn hands them to the GUI, where they are displayed as the status. The status includes the overall status, as well as the status of individual tasks.



System Copy Execution (Overall Status)

The execution of a system copy is limited to starting and monitoring the LSC Process.

Copy Phase	ID	Name	Start time	End time	Duration	Progress
Pre	LTEST_DBSHADOW	LIBELLE: Check DBShadow processes on s...	22.07.19 12:07:16	22.07.19 12:07:20	00:00:04	100%
Pre	LDBCONFIG_BACKUP	Backups the DB configuration files from the t...	22.07.19 12:07:20	22.07.19 12:07:24	00:00:04	100%
Pre	LTDBEROP	DB: Drop target DB	22.07.19 12:07:25	22.07.19 12:07:29	00:00:04	100%
Pre	LSPFILE_RESTORE	Recreates ORACLE spfile after drop of the da...	22.07.19 12:07:29	22.07.19 12:07:33	00:00:04	100%
Pre	LPRDCOPY	LIBELLE: Copy production DB	22.07.19 12:07:34	22.07.19 12:07:36	00:00:02	100%
Pre	LCOPICHK	DB: Check if database has been copied	22.07.19 12:07:37	22.07.19 12:07:39	00:00:02	100%
Pre	LTDBSWCH	LIBELLE: Activate database on target	22.07.19 12:07:39	22.07.19 12:07:42	00:00:02	100%
Post	LORADUSER	Recreates the ORACLE user based on sourc...	22.07.19 12:08:04	22.07.19 12:08:07	00:00:03	4%
Post	LSAPBAROLE	Execute the sapdba_role.sql script.	22.07.19 12:08:08	22.07.19 12:08:12	00:00:04	100%
Post	LABAPPSWD	BRCONNECT: Reset ABAP schema user pa...	22.07.19 12:08:12	22.07.19 12:08:15	00:00:03	100%
Post	LSLICENSEDEL	SAPLKEY: Delete content of SAP License K...	22.07.19 12:08:15	22.07.19 12:08:18	00:00:03	100%
Post	LSLICENSEIMP	SAPLKEY: Import content of SAP License K...	22.07.19 12:08:19	22.07.19 12:08:22	00:00:03	100%
Post	LORADIRECTORYSET	Set the ORACLE paths in view dba_director...	22.07.19 12:08:23	22.07.19 12:08:27	00:00:04	100%
Post	LORAINDEXBUILD01	Flag indexes recreated during the datab...	22.07.19 12:08:28	00:00:05	0%	0%
Post	LORAINDEXBUILD2	Rebuilds ORACLE indexes set to unavaila...				
Post	LDIRDEL	OS: Delete contents of work directory of SA...				
Post	LT00DEL	SCC4: Delete content of client configurations.				
Post	LT00IMP	SCC4: Import logical system names				
Post	LTABLEL	DB: Clear unnecessary entries				
Post	LORACLELDEL	DB: Delete contents of ORACLE specific tabl...				
Post	LBTJTRC	SM07: Delete content of Batch Jobs tables				
Post	LBTJSTMDL	Delete contents of tables for the STMS job fo...				
Post	LBTJBMP	SM07: Import content of Batch Job tables				
Post	LBTJSTMSIMP	Import contents of tables for the STMS job fo...				
Post	LRFCDL	SM69: Delete content of RFC settings tables.				

Phase and Task Details

The progress of individual phases and tasks is also displayed.

Automation of System and Landscape Copies

The aim of the LSC usage is the simple and complete automation of system and landscape copies – apart from planned break points (i.e. a manual check points performed by the administrator).

The automation of system and landscape copies reduces downtimes and dependence on the availability of specialists. Another of the main advantages lies in the repeatable quality of the results. Provided of course there are no unforeseeable incidents, e.g. a network failure, or unannounced or undocumented changes.

To keep you updated on these, LSC constantly delivers information about the current status of the system/landscape copy. Either through the GUI or through feedback mechanisms (e.g. combination with e-mail gateways or monitoring systems via SMTP or Windows events). If no unexpected incidents occur, the system/landscape copy gets executed automatically

Optimizing the Homogeneous System Copy

In the context of automation, LSC provides other possibilities besides task parallelization, for considerable optimization inside the individually encapsulated tasks. This includes porting of comparatively simple activities from application to database layer, as well as more complex optimization possibilities. An example for this would be the BDLS run, which can take from hours up to days, depending on the environment. For this and for other actions, LSC provides concrete options to significantly reduce execution time. Those optimizations are realized during the LSC implementation, together with the Libelle Consultant.

Further Functions and Best Practices

A variety of additional requirements have been revealed to us from the day to day work of Libelle customers. Many of them have been implemented via customizing and in some cases, they have been used to further develop our solution.

Here are some exemplary highlights, that aid day to day work:

1.5 Roles

Not every user, who wants to know the status of the copy, should be able to change the configuration. That's why the LSC role model innately comes with the roles "Reader" (just reading rights), "Operator" (reader rights plus able to plan, start, stop, etc. LSC runs) and "Admin" (operator rights plus ability to change configurations). The authentication can also be accomplished with LDAP directories.

1.6 Limited Execution times

Especially in more complex organizational structures, or in situations in which external personnel must run LSC, copies have been done at unfortunate times, leading to problems that could have been prevented. For this reason, execution times for system/landscape copies can be limited.

1.7 Logging and Documentation

Transparency is a must in critical environments, as well as in areas, where for various reasons, revision, auditor, departments or superiors are interested. Several standard reports deliver data and information in different information tiers during execution as well as after finishing. It's even possible to gather this data for previous LSC runs.

This logging and documentation simplifies the investigation for the cause in the case of an error.

1.8 Versioning and Signing of Tasks

If a copy encounters an error, the most important questions are "where" and "why". With the previously mentioned logging, the "where" can be answered quite quickly. With the help of versioning and signing, you can easily check if something changed in the configuration. If nothing has changed, the cause of the problem probably lies outside of LSC.

1.9 Template configuration

Especially in the enterprise and hosting context, there often are a multitude of similar environments. Users therefore have the possibility to individually define consumer-based basis configurations as templates.

Libelle Add-Ons and Further Solutions

1.10 Physical Database/Filesystem Copy: Libelle *DBCOPY*

The add-on Libelle **DBCOPY** integrates the online copy of databases and filesystems during the copy-phase of a system/landscape copy. No backup/restore/snapshot or other external tools are needed.

1.11 Data anonymizing: Libelle *DataMasking*

It's not always desirable to utilize real data in non-production environments. A common example in reference to the GDPR are personnel or customer data, which shouldn't be made available to user groups that work on a development or a project system.

Through the implementation of Libelle **DataMasking**, sensitive data can be obscured and overwritten. This way it is not possible to infer the original data from the obscured data. However, the logical consistency of the data remains, so business processes can be meaningfully tested across the whole process chain.

To realize this, there are multiple out of the box templates available, which can be tweaked individually by the customer.

1.12 Creation of System Clones/Sandboxes/Project systems: Libelle *SystemClone* Creation of Client Copy: Libelle *ClientCopy*

Based on the already described framework, Libelle provides further repositories for additional scenarios. In comparison to LSC, Libelle **SystemClone** not only takes over the refresh of an already existing environment, but rather the complete construction of additional target environments. Depending on the environment infrastructure, there are different variants possible.

Libelle **ClientCopy** on the other hand, enables the automated and optimized execution of client copies. Either within a system or between different systems.

It's also possible to combine the repositories. Practical examples would be a system refresh or a system clone, followed by a client copy, and finalized by an anonymization run.



Summary

Libelle **SystemCopy** significantly reduces the time and resources necessary to create homogeneous system and landscape copies for SAP applications through automation and optimization. Those responsible for the system are now able to concentrate on the more critical aspects of an SAP environment. The solution's safe and swift integration into any SAP environment, immediately leads to added value.

Another thing that distinguishes Libelle **SystemCopy**, is that it runs outside the ABAP stack. This way it can execute activities outside as well as inside the SAP system. In addition to the possible integration of existing infrastructure, such as storage snapshots, Libelle provides an own, highly efficient and fully integrable copy mechanism with **DBCOPY**.

The incorporation of further tools, e.g. data anonymization, is possible, as well as the support of other scenarios like system clones or client copies. The base task of Libelle **SystemCopy** however is the end-to-end automation of homogeneous system and landscape copies. From the first connect to the old system, up until the clearance of the renewed target system. Without any interruption.

More Information

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