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Managing SAP Test Environments: Best Practices for Complex Projects

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Abstract

Successful SAP implementations require effective SAP test environment management, especially when performing advanced platform migrations like S/4HANA, system upgrades, or large-scale rollouts. SAP systems manage core business processes such as finance, procurement, and logistics, which demand thorough testing to confirm proper functioning. The complexity of SAP landscapes especially in retail, e-commerce, and utilities industries increases when the testing involves migrations, integrations with third-party systems, and ensuring data integrity. This paper navigates through the challenges and best practices to manage SAP test environments, with a particular focus on data management during S/4HANA migration, SAP upgrades, and global rollouts. The paper emphasizes how Data management techniques like data anonymization and data masking, along with virtualization, establish security and alignment between SAP test systems and production environments, and landscape management tools together with data management tools to maintain robust testing infrastructures.

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1. Introduction

SAP is a comprehensive ERP suite that consolidates essential business functions, including finance, supply chain management, procurement, and customer relationship management. As organizations grow, their SAP systems need to evolve to meet new business demands. As part of this evolution, many companies in sectors like retail, e-commerce, and utilities are migrating to SAP S/4HANA, upgrading existing SAP systems, or rolling out new SAP solutions across various business units or regions.

Testing plays a crucial role in these complex transitions. As businesses transition to S/4HANA which alters system architecture and business processes SAP test environments become more critical. As organizations adapt to S/4HANA the requirement for comprehensive testing arises to maintain data accuracy and system performance standards. Data management—ranging from data migration to data integrity—is one of the most pressing concerns in these environments, particularly during migrations and upgrades ^[1].

This paper explores how best practices in data management help streamline testing processes, especially when managing test environments during S/4HANA migrations, SAP upgrades, and global rollouts. We will discuss the third-party system integration methods alongside the essential function test environments that serve in data accuracy maintenance and secure sensitive data management practices that companies must follow while still achieving the testing of real-world -business conditions. Moreover, we highlight the use of landscape management tools and data management tools that support seamless test environment setup and management, reducing complexity and improving data integrity ^[1].

2. Overview of sap testing in complex projects

SAP testing involves several phases to ensure a smooth implementation, integration, and rollout. These phases encompass:

1. **Unit Testing:** Testing individual SAP components to ensure that each unit of the system operates as expected.
2. **System Testing:** Testing the SAP system, ensuring that it meets the functional requirements and supports business processes.
3. **Integration Testing:** Verifying that SAP modules work seamlessly with each other and with third-party systems [3].
4. **Regression Testing:** Ensuring that updates and changes don't negatively affect the system's existing functionality
5. **User Acceptance Testing (UAT):** Involving business users to validate that the SAP system meets their needs.
6. **Performance Testing:** Ensuring the SAP system performs under various loads, particularly critical for high-transaction environments like retail and e-commerce [4].

Each of these phases requires well-organized test environments, especially when dealing with S/4HANA migrations or SAP upgrades. What makes these transitions particularly challenging is the need to maintain the integrity and consistency of data while simulating real-world business scenarios.

3. SAP Landscapes and test environments

The SAP landscape typically consists of several key systems that support the overall SAP architecture. The most common landscape is a 3-tier one, which has 3 systems within the landscape. Typically, these are Development-> Quality Assurance -> Production [5].

A development system is a system where changes, fixes, and projects are all worked on by developers or functional consultants.

The Production system is restricted from direct changes to customizing or repository objects to prevent the risk of unexpected accidents; therefore, test activities must happen outside of the production system when a new functionality needs to be tested. This gives rise to the need for an additional environment that acts as an intermediate system between the development and production systems, typically called a Quality Assurance system [5].

Below are the advantages of having this system:

- To provide an environment that includes 'production-like' data where the new requirements/changes can be tested [5].
- To connect with third-party systems (SAP & non-SAP) in order to test the interface connectivity and data flow between SAP/non-SAP systems.
- To verify the End-to-End business functionality and provide visibility of what should be expected in production.

The production system serves hundreds to thousands of users requiring constant availability and functionality to maintain stability, which assigns it top priority. Since SAP audits take place in this system, production transactions can only be executed here.

Apart from the above systems, there are other systems that are available optionally based on project needs.

- **Sandbox-** An SAP sandbox system is a testing environment where users can experiment with configurations, customizations, and transactions without affecting the production system. It's a separate instance designed for experimentation, training, and testing.
- **Performance-** SAP Performance Testing Environment, or SAP Performance Management System, is a test environment used to monitor, measure, and optimize the performance of SAP systems. It helps ensure that your SAP system performs efficiently, especially during peak loads or when handling large volumes of data.

Test environments need to match the production setup precisely for successful testing during S/4HANA migrations or upgrades. Efficient management of SAP landscapes demands using tools such as SAP Solution Manager and SAP Landscape Transformation (SLT). These tools facilitate the tracking of system configurations while managing updates and automating system refreshes and data migrations which ensures test systems remain synchronized with production environments and all modifications undergo thorough validation before deployment.

4. Challenges in managing sap test environments

During SAP S/4 HANA migrations or upgrade projects, effective test environment management needs multiple landscapes to address complex requirements. In large projects, it is common to have two separate landscapes. For major Development system work such as large-scale projects or major upgrades you can establish a parallel landscape to isolate project/upgrade activities from Business As Usual (BAU) changes. Through this approach organizations can minimize conflicts between project tasks and BAU operations which helps to avoid the implementation of a change freeze preventing users from receiving any new or improved products until the freeze period ends [6]. This setup is often known as dual track or multi-track, which is expressed as N+1, N+2, etc.,

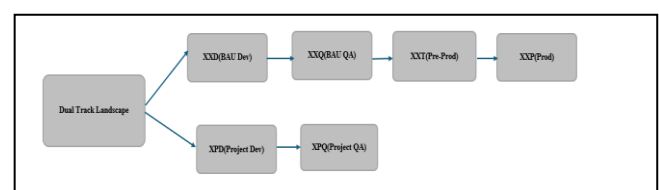


Fig 1: Example of a Dual Track Landscape

A. Significance of Two Separate Landscapes

The BAU (Business as Usual) Landscape and the Project Landscape both contribute essential functions to maintain an organization's IT environment. The BAU landscape supports continuous system maintenance and operation which guarantees smooth and disruption-free operations. The system manages standard updates and regular optimizations while monitoring operations which enables business activities to flow without significant interruptions. The Project Landscape serves as the testing ground where new features and customizations are developed before they advance to production status. This controlled environment

allows teams to test changes for functionality, compatibility and performance before deploying updates and new developments to the live environment. Maintaining business operations requires the BAU landscape and the Project Landscape enables innovation and improvement through structured development and testing ^[7].

B. Challenges during Testing

Managing both the BAU Landscape and Project Landscape introduces several challenges, especially during testing phases, as each landscape must be carefully handled to ensure smooth operations.

1. *Data Consistency Between Landscapes*- Maintaining data consistency between the BAU landscape and project landscape remains a major challenge when working with two landscapes. Changes made in the project landscape, such as new configurations, custom developments, or integrations, must be reflected accurately in the BAU landscape when emergency fixes are needed. Discrepancies between the two can arise if synchronization isn't managed carefully, leading to potential issues during testing as the project landscape may have updated data or configurations that are not yet mirrored in the BAU landscape or vice versa.
2. *Different Testing Needs*- The testing objectives for the two landscapes vary. The project landscape is used to validate new developments, upgrades, or migrations, while the BAU landscape focuses on ensuring that emergency fixes are stable and non-disruptive to production. Balancing these differing testing priorities—ensuring emergency fixes don't interfere with ongoing development testing—requires careful coordination and planning.
3. *Managing Urgency vs Stability in Testing*- The ongoing work in BAU landscape is often of priority to production issues quickly. However, this urgency can sometimes lead to rushed testing or insufficient validation, especially if emergency fixes overlap with areas being tested in the project landscape. This need for urgency can compromise the quality of testing, affecting stability.
4. *Complex Version Control and Transport Management*- With two distinct landscapes, managing version control and transport becomes critical. Transports in the project landscape may need to be back-ported into the BAU landscape to apply fixes in the live system. Any version inconsistencies can complicate the testing process, particularly if fixes tested in one landscape must be replicated or synchronized in the other.
5. *Resource Allocation and Prioritization*- Managing two landscapes can create challenges in resource allocation. Testing teams usually perform validation of new configurations and developments in project landscapes while they tackle critical testing requirements in business-as-usual operations. The simultaneous testing requirements from both landscapes create resource constraints because each requires substantial attention and testing system availability.

5. Best Practices for Managing Two SAP Landscapes During Migration, Upgrades, and Rollouts

Given the importance of data management during S/4HANA migrations, SAP upgrades, and rollouts, proper management of SAP test environments is critical to ensure seamless testing

operations and verify configurations, developments, and patches before deployment to production. Effective test environment management for SAP requires clear separation between development, quality assurance (QA), and production systems to eliminate conflicts and preserve data integrity. Testing priorities need clear guidelines, which should include scheduled windows for emergency fixes along with continuous testing of ongoing developments. Using defined testing environments (e.g., a QA system) within each landscape can help manage these priorities and prevent conflicts between emergency fixes and project testing. Automated data synchronization should be implemented, with regular data refreshes across both landscapes. By using tools like SAP Landscape Management (LaMa) ^[8], teams can ensure that the test environment accurately reflects the live system, which is essential for testing emergency fixes in a realistic scenario. It is also important to regularly synchronize test environments with production to ensure that the most accurate data and configurations are available for testing. Performance Testing with Realistic Data Volumes.

Mock cutover testing serves as an essential practice for the real cutover process. During a full-scale mock cutover, companies can test all integration points, confirm data consistency, and ensure that performance meets expectations under real-world expectations. This reduces the risk of disruptions during the live cutover and helps teams adjust processes or configurations that might need refinement.

Cutover testing, conducted after the mock cutover phase, is the final test phase where organizations confirm the system's readiness for the live environment. It includes validating that all critical processes, data, and integrations function correctly after the cutover phase is completed. Cutover testing helps ensure that the migration process goes smoothly without significant issues, particularly in areas where business continuity is paramount.

Additionally, implementing a test-driven deployment method ensures that the emergency fixes undergo a short mandatory cycle of testing in a dedicated emergency test environment. This ensures that fixes address the issue without introducing regressions or conflicts with ongoing developments in the project landscape. Leverage tools like SAP Transport Management System (TMS) along with change management tools to track and manage transports between landscapes. Implement version control protocols to ensure the correct versions of configurations, patches, and fixes are transferred accurately. Automated deployment and transport management tools like SAP Transport Management System (TMS) ^[2] and SAP Landscape Management (LaMa) should be used to streamline the process of moving configurations and custom developments between environments. Focus testing activities primarily on the most urgent and critical issues. Coordinated effort between testing teams who manage different landscapes helps to prevent resource constraints. Establishing exclusive testing environments for urgent fixes alleviates the burden faced by main testing teams who manage project landscape tasks. This ensures that critical fixes are tested without compromising the ongoing development testing. Testing documentation requires thoroughness through detailed test plan creation while establishing clear pass/fail criteria and systematic execution of all test cases with transparent result tracking for accountability.

6. Conclusion

During S/4HANA migrations and SAP upgrades alongside rollouts organizations must prioritize effective management of SAP test environments considering the critical role of data management. Organizations can establish secure test environments resembling production systems and maintain data integrity through data masking, virtualization, data synchronization along with the use of SAP Solution Manager and SAP Landscape Transformation (SLT) [9] landscape management tools. Integration of third-party systems and detailed data migrations are critical because they both play essential roles in migration success and optimal system performance. Through the implementation of optimal data management methods along with appropriate tools companies achieve risk mitigation and testing efficiency improvements which result in their SAP systems meeting business needs while protecting confidential information.

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