Tips for Successful System Integration Testing
Best Practices to Improve Your Testing Process
Introduction

Whether you are upgrading your human resources implementation in an enterprise, adopting a new electronic health record (EHR) solution in a hospital, or replacing the billing system behind your online commerce site, a key set of best practices can help your team avoid common challenges and conduct a successful system integration test every time.

The goal of a system integration testing (SIT) project is to verify that an existing software system continues to function properly after the introduction of one or more new software components. SIT is also done for completely new systems, but without the additional challenges of updating a system that’s already running in production.
Why Is System Integration Testing Important?

System integration testing validates that the system as a whole matches stakeholder requirements. Perhaps most importantly, it’s the last chance to find defects and issues before the new system goes live and problems start to negatively affect the users and, ultimately, the business.

Prior to this point in the software development lifecycle, testing is focused on individual system components, often relying on test harnesses or other artificial means to simulate the interaction between the component under test and other system components. When testing reaches the SIT stage, the interaction with other components is usually no longer simulated. The component is placed in a test environment that mirrors the production system, to see if it properly handles business processes that span components.

Small, simple system projects can get away with taking short cuts. Good SIT processes are critical for the bigger, more complicated systems typically found at the enterprise level. These six SIT best practices will help you establish a better process for performing testing on large, complex systems.

What is a System?

For the purposes of this guide, we'll use “system“ as shorthand for a collection of software programs in an enterprise, consisting of many disparate applications and services that must communicate and exchange information to support larger business objectives. When one or more of the system’s components are changed, the correct functioning of the entire integrated system must be verified.

System integration testing, then, is a phase in the software development lifecycle where the goal is to determine if the modified system works as expected before the changes are put into production.
Make Sure Your Test and Production Environments Match

It goes without saying that you shouldn’t conduct your initial system integration testing in production. All kinds of problems can arise when releases are tested in the production environment—database corruption, critical module failures, system crashes, and so on. Even making “minor” changes to the production system can cause serious problems.

Obviously, testing should be conducted in a separate test environment that mirrors the production system. Test environments allow teams to better manage releases, because they can complete basic performance and load testing earlier, while there is still time to make adjustments to the implementation approach. Test environments also provide more control over which version of a component or system is installed.

For a test environment to be effective, it’s important for it to be up to date. If changes have been made to the production environment that aren’t reflected in the test system, you risk problems cropping up in one environment that aren’t in the other, which only complicates and slows down the testing effort. Make it a part of your process to update your test environments whenever you update the production environment—even if it’s just a “tweak” to production.

Virtual Test Environments

Sometimes, teams feel like they have to test in the production environment because they don’t have enough machines to establish a mirrored test environment. However, advances in virtual machine technology have made it harder to justify not having a test environment.

Virtual machines offer a great way to run automated scripts in a separate, customized environment, which can exist without interfering with normal computer operations. The virtual machine can be configured to ensure the environment remains constant on each script run.
Use Good Test Data

To know if a system integration test is successful, you have to know what output to expect from the test data being input. For example, if you’re testing the integration of a hospital billing system, you should know what kind of billing statement that the test data, “Adult, age 50, no insurance, appendectomy” should generate. By identifying data in/expected data out, you can confidently define test success or failure. Otherwise, you may end up with poorly written or vague test cases that don’t help you successfully validate system requirements.

Another benefit of creating good test data is that test automation becomes a realistic possibility for basic regression tests and for driving test harnesses. Automating these practices can take a large burden off the testing team and significantly speed up your testing, recouping the time you spent creating the test data.

Don’t Forget to Reset

Along with good test data, it’s important to have a way to reset the systems that are part of the testing effort to some known starting point. This can mean resetting a virtual machine, dropping database tables and running create-and-load scripts, or deleting directories and their contents from servers and restoring files from a source code control system. Regardless of the reset method used, controlling the starting conditions means issues are more likely to be reproducible.
Use a Common Repository for Issues and Tests

A common repository ensures issues are visible across teams and makes it easy to reassign responsibility for investigation and issue resolution. Repositories provide a system-wide view of the state of issues and of production readiness.

Your issue and test repository should be available to all SIT participants to reduce the chance that issues will fall through the cracks. It also allows for better decision-making, because an individual issue can be viewed within the context of other issues. If you have different teams working on a common issue list, you need to make sure they are all seeing the most up-to-date list.

To ensure you’ve captured the information you’ll need to communicate efficiently and make the best decisions, we recommend that you document the following in your issue and test repository:

- A brief description of the issue
- Who found the issue, and when
- Steps to reproduce (steps from the test case or the specific actions and data that resulted in the issue)
- Affected component or subsystem
- Who is currently responsible for issue resolution
- Issue status (open, blocked, in progress, resolved)
- Fix priority
- Environment and build information
Establish an Issue Triage Process

In addition to establishing a common issue and test repository, you should also have an issue triage process that includes a triage schedule, identifies the team member who owns triage, and lists all participants. An effective triage process can help you balance the demands of decision makers, ensure high priority issues are fixed first, resolve priority conflicts, and maintain a history of issues fixed for a release. It can save you many headaches if you have it in place ahead of time, or really hurt you if you don’t.

A defined triage process is an effective way to provide a flexible, group-based approach to issue prioritization:

- **Decision-makers** can quickly find issues and assign a priority.
- **Moderators** can view priority conflicts and resolve them with the appropriate decision makers.
- **All team members** will have a clearer picture of the work to complete before a product release, which helps ensure high priority issues are fixed first.

Read “Triaging Issues in TestTrack” to learn more about establishing an effective triage process.
Have a Communication Plan

Establishing a plan for communicating between teams can keep projects moving smoothly through the SIT process, especially if some individuals or teams are geographically distributed. A communication plan becomes critical if the testing team contains remote, temporary, or inexperienced testers.

At a minimum, the communication plan should address how testers will be notified when their part is ready for testing, and how the team will manage handoff notifications to ensure the testing effort is conducted in the proper order.

Inexperienced and temporary testers may lack the basic knowledge more experienced testers have. Make sure the communication plan answers basic questions, such as:

- How do I know what to test?
- How do I let you know how it went?
- What do I do if it doesn't work?
- Who do I notify, and how (call, email, IM, etc.)?
- Where do I save my results?

A test management solution can simplify your communication plan by automating alerts, notifications, reporting, and other project-critical communications. However, you will also want to make sure your key contact list or lead matrix is updated and shared with the team.
Leverage Automated Reporting

Management is often eager for results, especially as deadlines approach and expectations for pushing changes into production increase. Without automated reporting, it can take hours just to answer a simple question like, “How did testing go today?”

Avoid this time sink before testing begins by leveraging a tool that can automatically deliver high-level status reports to management. Typically, management will want to see reports that include the following data:

- A list of the highest risk items
- The number of tests run that day
- The number of tests that have passed or failed
- The number of tests left to be run
- A breakdown by system, to identify what modules are causing trouble

Conclusion

These six best practices should help establish a better process for performing system integration testing on large, complex projects. Good test data and up-to-date test environments will help you establish a strong foundation for SIT. A centralized, integrated test management solution—combined with an efficient triage process—will help improve visibility and avoid errors during testing. And, leveraging automatic reporting can save time when communicating test and issue status to your team and stakeholders.
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