



ENHANCING SOFTWARE QUALITY

Scrutinize your Infrastructure – Test it Right

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1. Abstract

IT infrastructure comprises of many components. For successful functioning of any system independent and interdependent operation of these components are must. Each component is tested as a unit by a different stakeholder. Any change affects the stability and performance of the system which severely impacts the end user.

A holistic approach is needed for testing the infrastructure end to end with an integrated process ahead of the ever increasing IT complexities.

Key Takeaways

This paper brings out the test strategy with full focus and rigor needed for infrastructure testing. The key takeaways are:

Integrated streamlined approach for end to end testing

Unified team – Training and Operations

Higher ROI

Effective systems

2. Infrastructure testing – Transformation time

The core of any business is the underlying infrastructure. The IT landscape is constantly evolving with frequent changes in OS, browsers, firmware and drivers. These changes have a cascading effect on the applications running on top of the underlying hardware and firmware. Testing the application alone thoroughly will not weed out the deficiencies of the underlying architecture. This juncture is of high risk which may cause system failures, performance issues and downtimes.

Today, any business requires IT to enable them with business SLA which makes Infrastructure and application team to be integrated in many aspects. Linkage with Infrastructure is more challenging due to complexity and ever changing technologies demand the testing and verification of infrastructure as a separate entity.

What are the impacts?

- Unwarranted system failures, performance issues and unplanned downtime
- Post deployment errors that lead and require highest cost of corrections
- Deviation from the SLA that impact compliance and maintenance costs
- Lack of standardized processes which gives out Inconsistent results and deliverables
- Communication gaps within the teams (Application testing and Infrastructure testing) results schedule variance and late deployments. These impacts the time to market further the application reliability and stability will be at stake.
- Cyber-Security is typically enabled at the infrastructure level
- Disaster recovery and Business Continuity Planning is critically dependent upon tested infrastructure that is dependable and self-similar across the primary and secondary sites
- DevOps is blurring the lines between application and runtime environment. Horizontal scaling of applications relies upon the ability to spin up and bring down virtual servers instantly in response to varying user loads
- In the future, software configured compute, storage and interface components will further complicate testing (STeP-IN SUMMIT 2015 keynote by Murali Nandigrama)
- Corporate actions (mergers and acquisitions) change the infrastructure landscape and impact the hosting of applications and business processes.

Impact of these failures affect various verticals severely –like Retail, Banking, Health care.

Are we prepared for facing such failures? Are we doing enough testing to overcome these?

3. What is infrastructure testing?

Infrastructure testing is about testing the application runtime environment, which is a collection of building blocks or components that can be used for supplying functionalities towards other applications. Potentially these building blocks can have innate functionalities for an end-user by a provided user interface. The building blocks can consist out of one or more (hardware) appliances or software solutions. It is easily possible that these building blocks are not visible for an end-user (e.g. network switch, firewall, routers, etc.).

Infrastructure testing is any test activity performed as result of the setup of or an intervention made on hardware, network and/or software components which are part of an integral infrastructure platform in order to facilitate applications in a managed and controlled way.

Based on the business requirements, the QA team carries out application testing in isolation on top of the underlying architecture and operating system.

Application testing

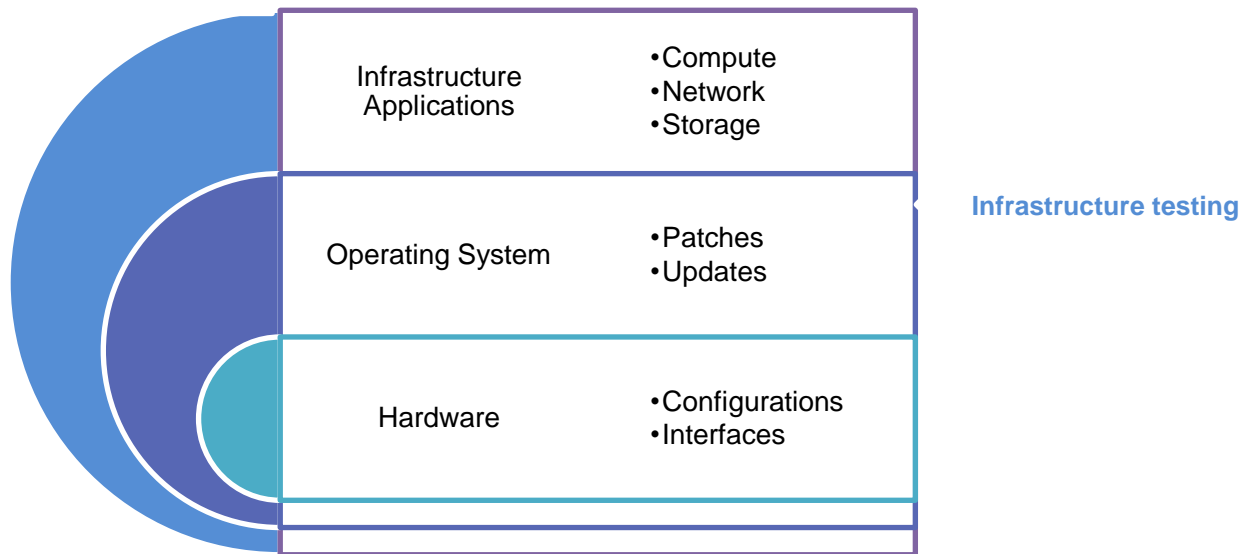


Fig. 1.1

Infrastructure testing is carried out including the hardware, OS and the firmware along with application functional testing.

4. Focus Areas

The types of changes that happen in the IT infrastructure largely depend on the IT landscape volume and complexity of any organization. The following are some of the triggers for performing an Infrastructure testing.

- New / update Operating system / patch releases
- Updating OS in the Middle tier and or backend
- Hardware changes / configuration changes
- Firmware revisions
- Infrastructure Applications
- Database migration
- Data Center migration
- Memory upgrade for servers
- New tool implementation
- Mail server upgradation
- Horizontal scaling responsiveness
- DR/ BCP certification

5. Myths

1. Infrastructure testing can follow conventional testing approach

The standard test processes used for application testing will not be sufficed. An enhanced approach is needed to cover the focus area of testing end to end. Most often the status of infrastructure of any organization is thought of in an assured state and hence no focus is given to test it.

The testing types are the standard ones but the strategy used differs for infrastructure testing.

2. Infrastructure testing by a single testing team

Testing cannot be carried out in isolation by an independent testing team. If a data server migration is happening, then the QA team should comprise of members from database administration team, network team and IT team. They should work together for a successful migration. It is mandatory to have people from the other horizontals for a successful migration.

3. Infrastructure testing does not need any training

The test strategy for infrastructure testing is different from conventional types of testing. There are various focus areas that has to be concentrated and prioritized. The team has to be trained for carrying out a successful infrastructure testing. Database administrators, network personnel, Operations personnel need to be trained on the testing aspects whereas the QA team should be trained on the network, operations, database backend aspects. It's a niche area which needs some basic training to have a successful infrastructure testing team.

4. Infrastructure testing require a high investment

It does not need a high capital cost for performing the infrastructure testing. Minimal investment is needed for training the resources. Teams can be cross trained – IT, network, operations personnel with testing knowledge can coordinate with the QA team for testing the infrastructure.

6. Gaps

1. Complex / Insufficient requirements
2. inappropriate planning
3. Inadequate resources
4. Standards and processes
5. Poor visibility
6. Un matching time zones
7. Miscommunication
8. Lack of coordination

7. Challenges

- Requirement understanding
- Changing requirements
- Stakeholders involvement
- Knowledge base on the focus area of testing
- Unavailability of proper documentation
- Unavailability of infrastructure
- Access to the test lab
- Setting up the team
- Team coordination
- Communication channel
- Inadequate training
- Unmatched time zones

8. Framework

8.1 Infrastructure testing types

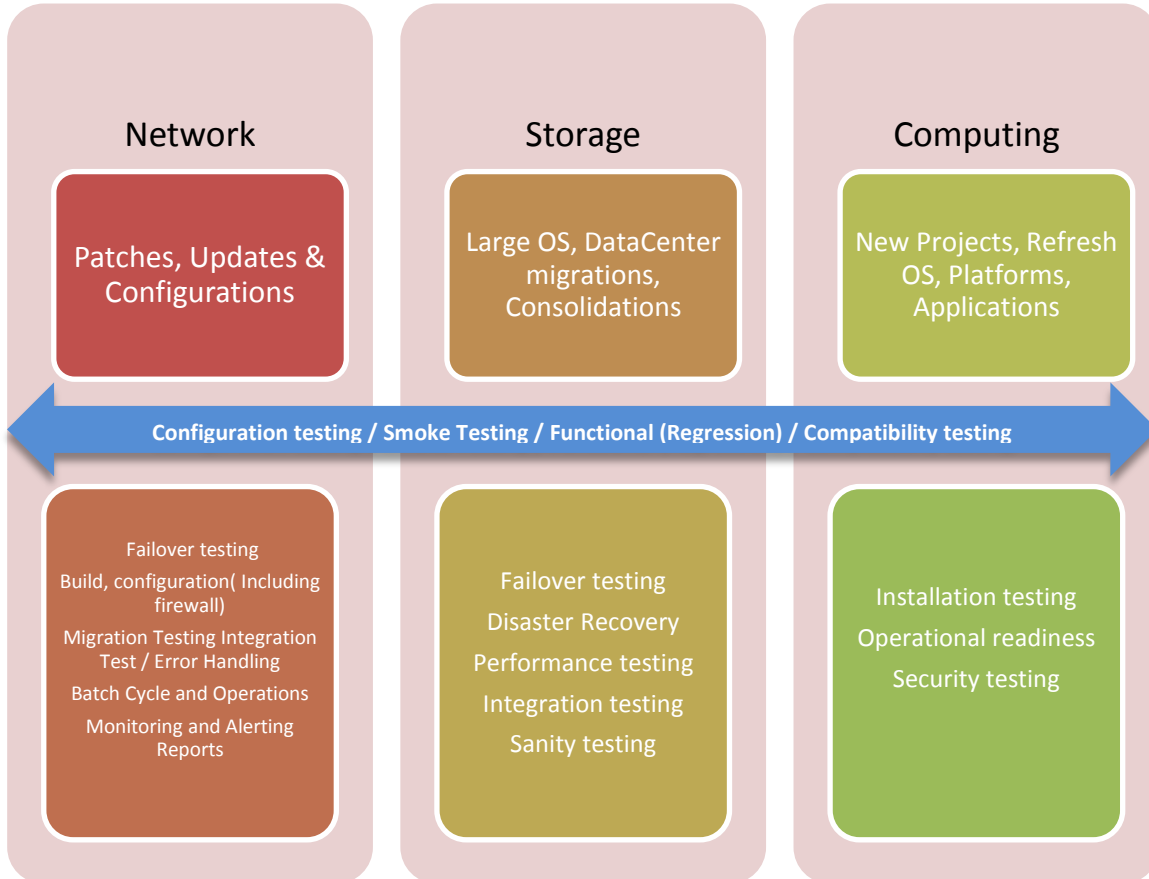
There are no special testing types categorized under infrastructure testing. But due to the complexity of the infrastructure in any organization, any change in the environment triggers the key for infrastructure testing.

Infrastructure testing is not limited to

- Data Center migration testing
- Platform migration testing

- Integrated communication testing
- Mail Server migration testing
- Database migration testing

8.2 Framework

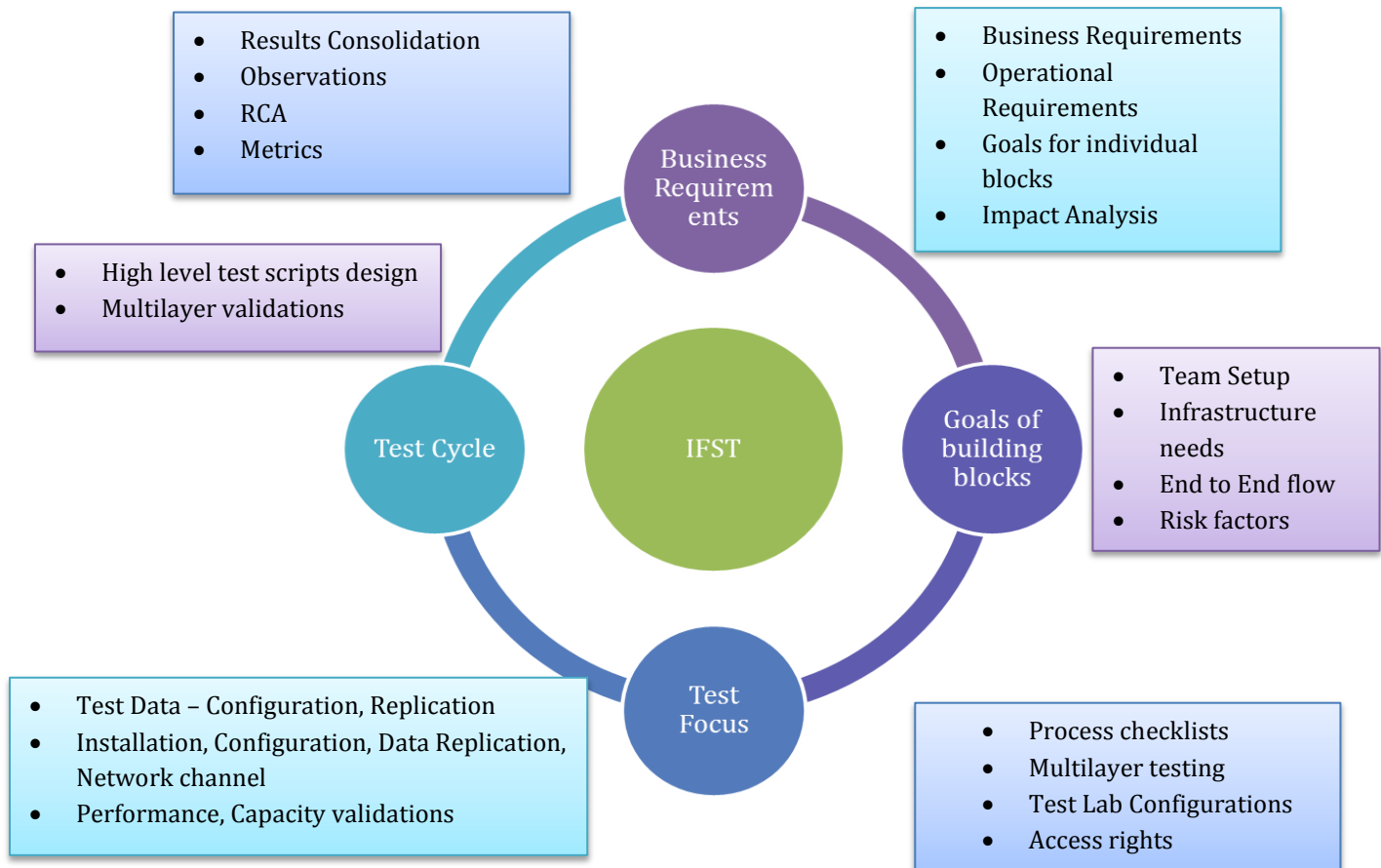


8.3 Test Approach

- Test approach will be focused on completing Testing successfully for all the upgrades/changes in Test Environment
- Test Approach is decided and a checklist is created noting down all the step by step activities to be done in the test process.
- Risk Assessment is done and based on the impact areas like server data where alternate testing servers to be used
- High level test cases for all the stages written and reviewed and should be approved by the client
- Installation & Configuration test, Scalability, Monitoring components and connectivity
- Configuration details to be obtained from the client for carrying out installation testing or configuration testing
- Appropriate users and user credentials to be created and obtained from the stake holders
- Data flow between different components, Platform Integration test, operational readiness test
- Risk and Assumptions definition, Collaboration with various internal and external stakeholders/vendor teams
- Availability and Critical success criteria definition for the various infrastructure components

8.4 Test Process

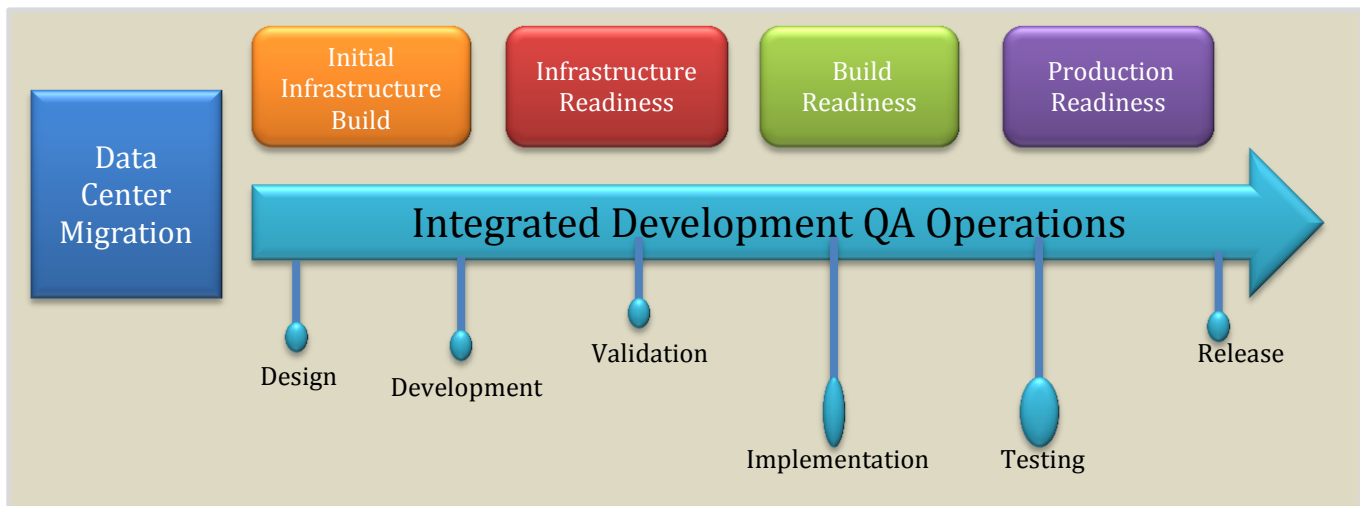
- Checklists, installation checklist, configurations checklists, execution focus and results are the documents to be created for any infrastructure testing.
- Jump start kits are extensions to the checklist and expected results for an installation / configuration of the new infrastructure.
- High level scripts developed for the target validations
- Target validations may be for configuration conditions, connection validations, network channel validation, data replication validation, performance validation, capacity validation
- Low level test cases should be written for migration projects that is for the database.
- Test Data for infrastructure testing includes multi-technology application configuration specifics - Interfacing physical hardware, firmware and software paradigms
- Test Conduits / Test Harness and other intellectual components like OS Ghost images, virtualized app services, JVMs etc.



9. Case Studies

9.1 Mail Server Migration testing

- i) **Business Requirement:** To check the functionality of the mail server after migration
- ii) **Testing scope:** To ensure the mail functionalities works after migration.
- iii) **Testing types:** Configuration testing, Installation testing, Database testing, Functional testing, Performance testing
- iv) **Risks:**
 - a) Unavailability of critical information on configuration and database
 - b) IT department personnel coordination for testing the network and configurations



v) Test Approach

Test plan created with detailed test strategy and approach. Team formed including members from IT department with server and network essentials along with the testing team.

High level test scenarios developed for validating the configuration. Low level test cases are written for core functionalities of mail.

Mail server migration planned date is intimated to all the stake holders and backup of data is done.

Planned migration done by the IT team. Testing phase started after migration. Configuration details before and after migration validated with details obtained from the IT team. Installation testing done in different configuration systems to ensure compatibility. Performance testing carried out for identified critical scenarios to measure the response times across functionalities.

Test execution for core functionalities done using the low level test cases and test results captured.

vi) Observations

Configurations tested and no issues found.

Slower performance observed and while troubleshooting the root cause, identified a network issue which is addressed and resolved.

Multiple issues reported in Installation testing in Windows 7 (32 bit) configuration

Detailed report prepared and shared with the service provider.

Retesting done to ensure all the issues are resolved.

9.2 Data Center Migration

i) **Business Requirement:** Datacenter migrated to accommodate the increasing user base with a higher configuration infrastructure. To test the database after DataCenter migration

ii) **Testing scope:** To ensure the data is intact and not lost after migration. Application is a hospitality management application which helps in making holidays and hotel bookings with million user base and million dollar revenue week after week. Migration should not impact the day to day operations and huge risk involved.

iii) **Testing types:** Configuration testing, Installation testing, Database testing, Functional testing, Performance testing, Disaster Recovery testing

iv) **Risks:** a) Migration should not impact the user base and the revenue. b) Unavailability of critical information on configuration and database b) Database Admin coordination for testing the configurations and database

v) Test Approach

Test plan created with detailed test strategy and approach. Testing Team in collaboration with Database Admin team. Performance testing team for performance testing

High level test scenarios developed for validating the configuration. Low level test cases are written for validating the data

Mail server migration planned date is intimated to all the stake holders and backup of data is done.

Planned migration done by the IT team. Testing phase started after migration. Configuration details before and after migration validated with details obtained from the IT team. Installation testing done in different configuration systems to ensure compatibility. Performance testing carried out for identified critical scenarios to measure the response times across functionalities.

Resilience and failover testing done to ensure consistency. Backup and Restoration testing done to ensure during any major failures, backup taken automatically.

Test execution for core functionalities done using the low level test cases and test results captured.

vi) Observations

Configurations tested and no issues found.

Site performance good for 200 users but with increasing work load to 500 users there is a heavy impact on the response times. Stakeholders arrived with a decision with this and addressed the root cause.

Regression performed and functional issues reported in production.

Detailed report prepared and shared with the service provider.

Retesting done to ensure all the issues are resolved.

10. Summary

- Improved Reliability, Accessibility and Security
- Provides agility with increasing complexity
- Introduce smaller changes quickly
- Provide assurance that services function in a managed and controlled process
- Increased coordination – reduce effort loss in collaboration and communications
- Cost savings in operations
- Reduction in downtime
- Reduction in rework cost

Due to the above, infrastructure testing increases the stakeholder's confidence. The cycle time is reduced and thereby reduces the time to market.

IT infrastructure is becoming more complex day by day demanding significant effort and focus.

Infrastructure /Data centers becoming huge and continue to expand multifold hence exposing them to a variety of risks.

They have to identified, assessed and managed continuously. It can be managed using various frameworks and solution accelerators discussed in this paper. It is also important that IT organization should have an open culture in sharing the information. Discussed in the paper is not the only single solution for any IT Infrastructure issue but best practices shared can make up an accelerated solution. Scrutinize, assess, test and manage it right.

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About Indium Software

At Indium Software, we've been entrenched in the world of software testing since 1999. We've built a team of 450+ software and test professionals in our offices in Chennai, Bengaluru, New Jersey, Sunnyvale, London and Kuala Lumpur.

The core of Indium's objective to servicing our global customers can be explained with this simple line: "We're small enough to care, large enough to deliver." We are a preferred testing vendor for enterprise and ISV customers ranging from Fortune 100 to 5000 companies and small to medium enterprises.

Till date, we've served over 250 clients in the U.S., and Rest of the World.

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