White Paper

TEST OPTIMIZATION FOR TODAY'S CONVERGED INFRASTRUCTURE

February 2012

Rev. A 02/12

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Test Optimization for Today's Converged Infrastructure

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EXECUTIVE SUMMARY

Network infrastructure is the foundation for all applications and services, even in virtualized and cloud computing environments. Today's businesses rely on that infrastructure in some way for nearly every business objective they have, some of which are mission-critical. This creates the need for the entire network infrastructure to have high levels of performance, availability, scalability and security. The only way to be sure these objectives are met is through comprehensive infrastructure testing, and the best way to address that is by using infrastructure test optimization (ITO).

ITO is the intelligent and sustainable deployment of test resources and systems to maximize test orchestration, collaboration, productivity and execution. ITO is thus a set of test practices deployed to ensure infrastructures meet a defined quality of service and quality of experience required to deliver strategic business objectives. ITO provides organizations with capabilities to help deliver quality products to market more cost-effectively and consistently, maximizing their profitability.

With more companies building entire businesses around infrastructure, there have been an increasing number of high-profile infrastructure outages. Amazon Web Services, Sony PlayStation Network and Netflix have all experienced costly service interruptions. To raise infrastructure quality and reduce infrastructure failures like these, IT leaders should adopt ITO. By deploying ITO best practices, test organizations can also identify opportunities to maximize test efficiency, mitigate risk and meet customer requirements.

In order to achieve the full benefits of ITO, engineering organizations must have the right tools and technology. Spirent offers a broad, integrated set of tools that support ITO practice areas including emulation and analysis, test automation, developer testing and lifecycle virtualization. These tools also deliver on key ITO benefits including traceability, collaboration, integration, realism and methodology.

BACKGROUND

Information technology and related infrastructure is a critical element of almost every business. Yet, for most companies, high quality networks are not the end goal. Business organizations are ultimately focused on obtaining new customers, increasing profits and outperforming competitors. To meet these objectives, businesses work toward specific goals that make sense for their particular industry and their unique situation. These may include a combination of: Faster time-to-market, higher quality, increased customer satisfaction, lower costs and greater innovation.

While communications infrastructure is not the ultimate business objective, practically every business has a critical dependency on it. Faster time to market depends on collaboration between interconnected teams that are located around the world. Higher quality depends on automated systems that repeat front office, back office and supply chain activities consistently every time. Cost reduction depends on just-in-time suppliers that exchange orders in real time. Without the relevant infrastructure, most businesses cannot function, let alone succeed.

Businesses today require systems that are designed, built and tested to meet the demands of an always-on, always-connected, always-available world. At the same time, network complexity has increased dramatically, putting additional strain on all parts of the organization. To have any chance of success, businesses must have an infrastructure that simultaneously delivers performance, availability, scalability and security (PASS). After all, every service—insignificant or essential—depends on the infrastructure.

Even in the age of virtualization and cloud computing, infrastructure has never mattered more. When these technologies are used, the level of resource sharing by applications and related services is unprecedented. Applications no longer get their own dedicated servers, storage or subnets. They share CPUs, I/O channels, storage area networks (SAN), virtual switches, virtual load balancers, virtual firewalls and more. Infrastructure is becoming a separate managed layer that is shared by multiple applications, services and sometimes even separate customers.

The most modern and advanced infrastructures can still fail. In April 2011, a major OTT provider suffered a multi-day infrastructure outage. A simple router configuration error led to a number of events—including a cascading series of network transmission storms—which kept services from fully recovering for several days. Businesses that depend heavily on properly functioning infrastructure must find ways of testing these real-life scenarios before they actually happen.

THE NEW PERSPECTIVE ON INFRASTRUCTURE

Customers, employees and partners derive value from applications and other services—not directly from the infrastructure. Most of them don't know exactly how the underlying infrastructure works. More importantly, they just don't care about infrastructure. Large organizations take advantage of specialists that have deep expertise within narrow technology domains. Some of them only focus on a single large-scale application or database and depend on other individuals or teams for infrastructure knowledge and support. Infrastructure management teams have traditionally been separated further into sub-groups that specialize in a single type of infrastructure such as servers, network or storage.

As virtualization and cloud computing take hold, perspectives on networking infrastructure are changing. Instead of only organizing specialists around different types of infrastructure, more infrastructure staff members, and even entire teams, are taking a comprehensive view of the infrastructure. They don't really have a choice. Servers, networks and storage can no longer be managed completely independently. Infrastructures are becoming less about distinct components and devices, and more about a single integrated and orchestrated layer serving a huge variety of different applications and services.

Organizational structures and management approaches are not the only things that need to change to support virtualization and cloud computing. Infrastructure testing must also adapt to the new realities of these evolved infrastructures. Just as with infrastructure management, testing of servers, networks and storage can no longer be done completely independently. As infrastructures become more integrated, so must the process of testing. At the same time, infrastructure testing has a number of historical challenges that must also be addressed.

INFRASTRUCTURE TESTING CHALLENGES

Infrastructure testing challenges have increased for several different reasons: Overall demand for testing has grown; infrastructure components have become more complex and interdependent; test methodologies have not always kept pace with advances in infrastructure; and new technologies such as virtualization and cloud computing have impacted the behaviors and characteristics of infrastructure. These challenges are not only impacting businesses, they also suggest the need for fundamentally new approaches to infrastructure testing.

Customers and employees depend more and more on ever increasing amounts of infrastructure. that enable a positive end user experience service providers deliver a steady stream of new services month after month. Application updates are released at a faster rate. All this activity has increased the overall demand for testing, straining the resources and even the capabilities of test organizations. The time available for testing—as well as the time for individual test cycles—is decreasing. Test engineers can't afford to spend this precious time running manual tests, searching for the right tests or building new tests that should have been leveraged from other efforts.

With virtualization and cloud computing, infrastructure components have become far more complex and interdependent. Networks are converging and becoming more virtualized, extending well beyond the physical world of switches, routers and cables. Virtual machines are moving from server to server, crossing subnet and VLAN boundaries. Some test tools can't keep up with all the new infrastructure capabilities. Test cases are also becoming more complex, and test development and maintenance is becoming more difficult and time consuming.

Test methodologies are yet another aspect of testing that have not always kept pace with advances in infrastructure. Many organizations never test the entire shared infrastructure in a realistic, integrated and holistic fashion. They assume, too often, that infrastructure validation is a by-product of application testing, forgetting the unpredictable demands of multiple applications competing for shared resources. A focus on testing individual applications made slightly more sense when applications had their own dedicated hardware. However, applications running in virtualized and cloud environments have little, if any, dedicated infrastructure.

New technologies can dramatically impact the behaviors and characteristics of the infrastructure. Utilization levels aren't just increasing for servers. They are also growing for networks and shared storage devices. This makes it harder to ensure realism of test scenarios, which includes pushing the infrastructure to its limits—and sometimes beyond. At the same time, the release of new technologies and feature upgrades are now so frequent that test teams can't always keep up with revalidation testing.

Taken together, these challenges are producing real business impact. They are raising the costs of testing, from building and maintaining test libraries to performing individual test cycles. Unfortunately, the push for rapid releases—for both software and hardware—is forcing quality versus timeliness decisions. When the wrong decision is made, or when the law of averages finally catches up, massive infrastructure failures end up hurting the company's image and bottom line. Hindsight always suggests that it would have been better to identify the issues during testing, and fix them prior to release.

When infrastructure failures do happen, they can result in negative publicity, lost customers and lost revenue. Again in April, 2011, a major gaming network was hacked, leaving the service unavailable for more than 20 days. Personal details from approximately 77 million accounts were stolen. Given the extensive impact, failures such as this must be prevented whenever possible. To reduce the risk of infrastructure failures, testing must address a number of factors—including performance, availability, security and scalability.

There is still more bad news. Automation is no longer enough to overcome these challenges. Just as infrastructure management teams are handling infrastructure more holistically, infrastructure test teams must begin to approach testing holistically as well. This still requires automation, but it also demands collaboration among test team members. It calls for optimization of available resources. It begs for more efficient and effective test activities. What is really needed is an integrated, holistic test strategy.

INFRASTRUCTURE TEST OPTIMIZATION

Leading development and test organizations are using an emerging approach to infrastructure testing called Infrastructure Test Optimization (ITO). ITO is the intelligent and sustainable deployment of test resources and systems to maximize test orchestration, collaboration, productivity and execution. ITO is thus a set of test practices deployed to ensure infrastructures meet a defined quality of service and quality of experience required to deliver strategic business objectives. ITO provides organizations with capabilities to help deliver quality products to market more cost-effectively and consistently, maximizing their profitability.

Please see Figure 1 for an overview of ITO.

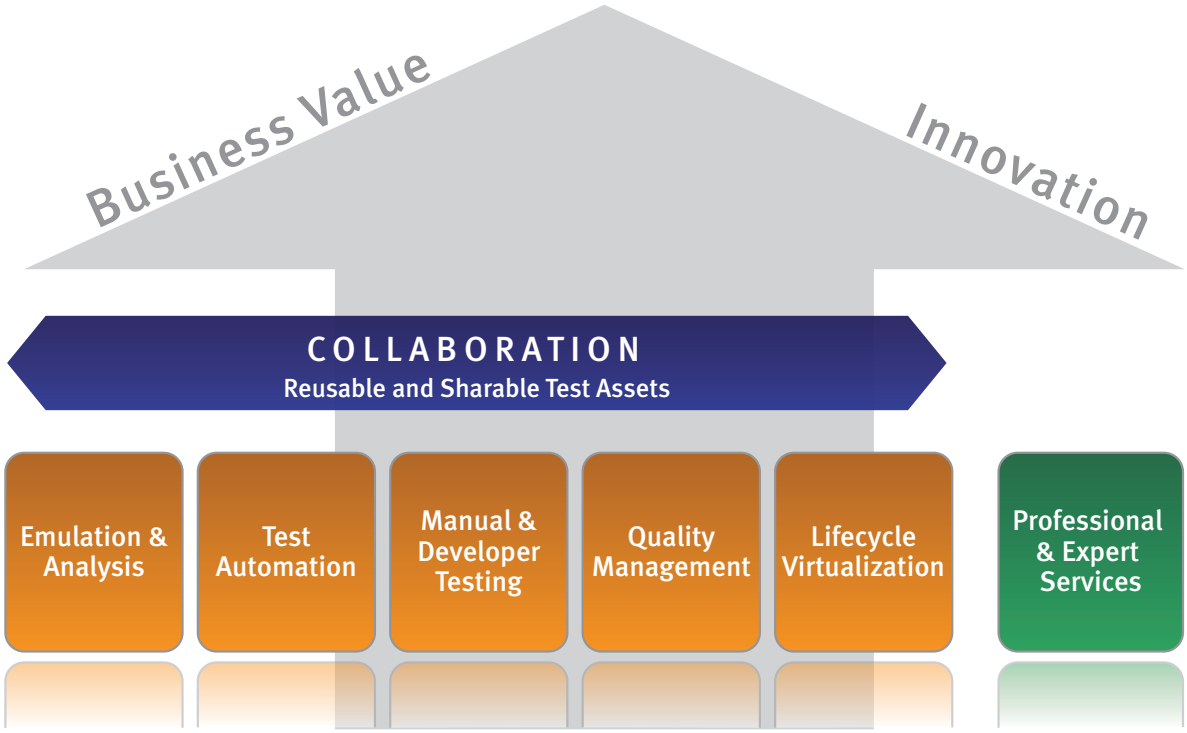

Figure 1

As shown in the diagram, ITO encompasses five primary practice areas: Emulation and analysis, test automation, manual & developer testing, quality management and lifecycle virtualization. The practice areas collaborate through common, shareable and reusable test assets. Collaborative effort through improved communication between and across practice areas is supported and encouraged. Finally, practice areas may also be complemented by professional and expert services. Together, these elements of ITO enable an organization to test their infrastructures in a holistic and integrated manner and, in the end, help drive business value and innovation.

Understanding ITO

With an overview of ITO in mind, it is helpful to dig deeper to understand each of the ITO practice areas as well as the key benefits.

ITO Practice Areas

Practice areas are at the core of ITO. Along with guidance through expert services, they help build a complete, cohesive and collaborative platform to enable optimization of infrastructure testing.

The five ITO practice areas are:

1. **Emulation and analysis**: Reproducing real world networks and/or actively simulating real users on the network to ensure infrastructures meet design requirements including: Verification of conformance to networking standards, meeting performance of functional requirements, and measuring performance under load at scale.
2. **Automation**: Using tools to establish test pre-conditions (including management of physical/virtual/lab resources), efficiently developing and executing tests, comparing actual versus predicted test outcomes, providing in-depth reporting, and handling lights-out regression testing.
3. **Manual & developer testing**: Testing of the software by developers to verify functionality of new capabilities. Includes manual testing and also establishes documentation as a pre-cursor to QA testing.
4. **Quality management**: Using tools to link business requirements to test cases, efficiently managing previously specified tests and resources, and tracking defects. Assets under management may include requirements, reports, metrics and defects.
5. **Lifecycle virtualization**: Providing on-demand access to critical resources needed for testing such as: Environments, virtualized test equipment, servers, devices, databases, and defects.

ITO Benefits

Organizations adopting ITO practices are not just looking for new methodologies or tools to implement them. They want to improve the entire development and test lifecycle, including test orchestration, collaboration and productivity.

They look to ITO for specific benefits that include:

- **Visibility**: Provides tools for a detailed drill-down into the quality environment. Helps provide data for analysis to make informed release-based decisions.
- **Traceability**: Helps correlate activities across the entire infrastructure test workflow. This enables full lifecycle versioning and complete traceability from requirements and tests, to defects and remediation.
- **Collaboration**: Provides sharing of knowledge, activities and test assets. This enables teams involved in a common task to achieve their goals more effectively. Collaboration also includes centralized data management, workflow management and shared documentation.
- **Integration**: Enables interoperability with all the discrete elements in the infrastructure. This allows authoring of highly repeatable, integrated tests, and end-to-end orchestration through workflow automation leveraging industry standards like NTAF.
- **Realism**: Ensures that infrastructure test stimulus is based on real world conditions. This includes accurately emulating network traffic and simulating real users consuming services.
- **Productivity**: Offers productivity gains through embedded test expertise, improved collaboration, integrated test orchestration, optimum test execution, and efficient utilization of resources.

Testing Standards

ITO embraces standards-based initiatives such as the Network Test Automation Forum (NTAF) which facilitates and promotes the interoperability of commercial testing tools and test infrastructure for the data communications and telecommunications industry. More information can be found on the NTAF website at www.ntaforum.org.

SPIRENT OFFERINGS FOR ITO

Spirent has a rich set of products and services for implementing nearly all aspects of ITO. Those looking for additional capabilities—such as requirements management and analytics—can take advantage of integrated offerings such as IBM Rational Quality Manager or HP Quality Center/ALM. Several of the core Spirent offerings—which are designed to deliver on the promise of ITO, are shown in Figure 2 and described in more detail below.

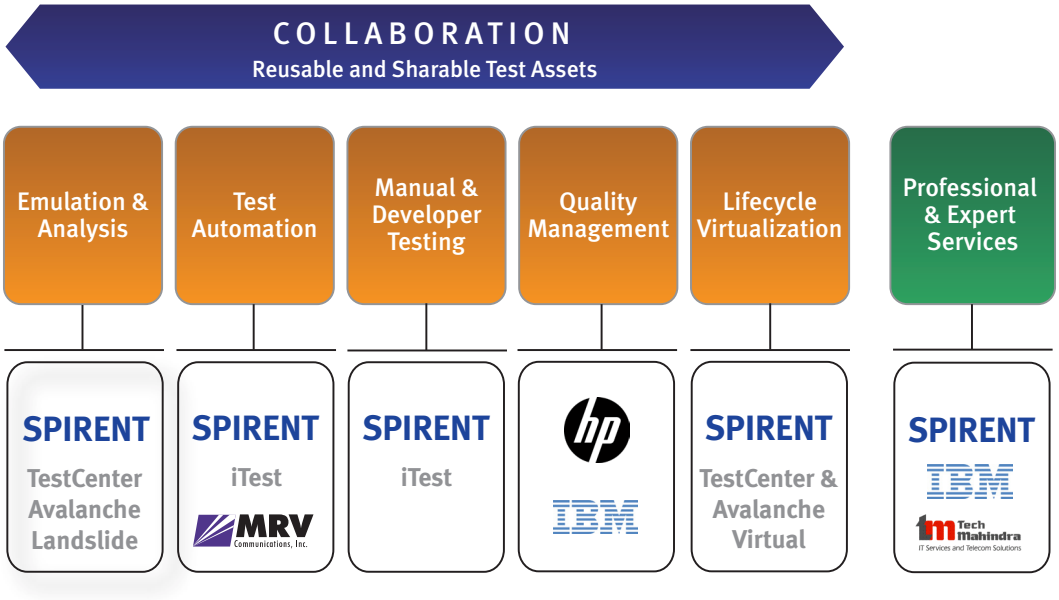

Figure 2

Spirent iTest

iTest is an award winning integrated development environment (IDE) for automated test development. It enables rapid authoring of complex, heterogeneous, system tests and provides a rich set of test authoring, execution, and analysis tools. With iTest you gain a single solution for functional, performance, load, and stress testing of systems and equipment. And very importantly a standard test case format so test assets can be easily shared across the organization and with partners, suppliers and customers. From an ITO perspective, iTest serves the test automation and developer testing practice areas.

Spirent iTest Team Server

As a server-based product, iTest Team Server enables the test community to work together more closely and collaboratively. It includes an analytics dashboard and tracks results and automation progress using built-in metrics. This allows managers to make evidence-based release decisions, reducing the reliance on opinions and gut feelings. It also includes a solution for manual testing that allows the results of manual tests performed by the entire team to be automatically documented and integrated into the system. From an ITO perspective, iTest Team Server provides value to the collaboration and the manual testing practice areas.

Spirent TestCenter

Spirent TestCenter™ minimizes risk by emulating complex networks and realistic traffic patterns and issues when they occur. This application of high scale traffic under real world conditions is used to test network and appliance virtualization as well as cloud, mobile and application experience. From the ITO perspective Spirent TestCenter serves the emulation and analysis practice area, while Spirent TestCenter Virtual serves the lifecycle virtualization practice area.

Spirent Professional Services

Spirent's Professional Services teams—along with best-of-breed technology partners—develop and deliver a range of ITO solutions using Spirent's world-class test tools. Originally offered under Spirent's NoCode banner, these solutions address the broad range of problem areas faced by organizations struggling with the cost and complexity of testing. They also deliver the greatest opportunity for increased efficiency, improved quality and testing scale, resulting in lower CAPEX/OPEX.

Companies of all types—from enterprise organizations to service providers—are taking advantage of Spirent offerings to overcome the challenges of testing and gain the benefits of ITO.

ITO BENEFITS DELIVERED BY SPIRENT SOLUTIONS

Together, the Spirent solutions for the ITO market deliver increased test coverage, improved collaboration, and more efficient use of resources. All this helps drive innovation and deliver quality products and services to market on time. ITO solutions also help link business requirements to the early stages of the quality process and trace them throughout the entire development lifecycle to mitigate risk. There are a number of additional benefits that are worth exploring further.

Since the overall demand for testing has grown and the pressure for faster test cycles has increased, Spirent solutions for ITO are continually adding higher levels of automation. Together, these solutions deliver a platform for productivity by offering automation within and between each product to address the entire test lifecycle. Test activities from authoring and set up, to execution and analysis all benefit from increased levels of automation.

With the tightly integrated infrastructures that are prominent in virtualized and cloud computing environments, organizations must take a more holistic approach to infrastructure design, deployment and management. The same is true for testing. Spirent ITO solutions enable the collaboration that is needed to bring together disparate tools, skills and capabilities to validate the entire IT infrastructure. Allowing the sharing and reuse of resources and coordinating interdependent activities are other important elements delivered by Spirent solutions for ITO.

Network infrastructures have grown more complex than ever, extending from silicon to devices and from LANs to WANs. To ensure the appropriate level of validation at each layer of infrastructure, Spirent ITO solutions provide the traceability required to link each requirement to any test activity. Spirent solutions also provide visibility to all lifecycle activities, including on demand analytics for in-depth understanding of failures as well as broader perspectives on progress.

Infrastructure testing has always demanded realism. Yet, with virtualized and cloud infrastructures, it has become much more difficult to achieve. Spirent ITO solutions are designed to emulate real-world scenarios that are appropriate for the entire shared infrastructure, not just the dedicated hardware that used to be associated within individual applications. This includes the ability to exercise and validate virtual switches with full control of virtual machine to virtual machine traffic within the same physical server.

To see how each of the key ITO benefits is delivered from individual Spirent products, please refer to Figure 3.

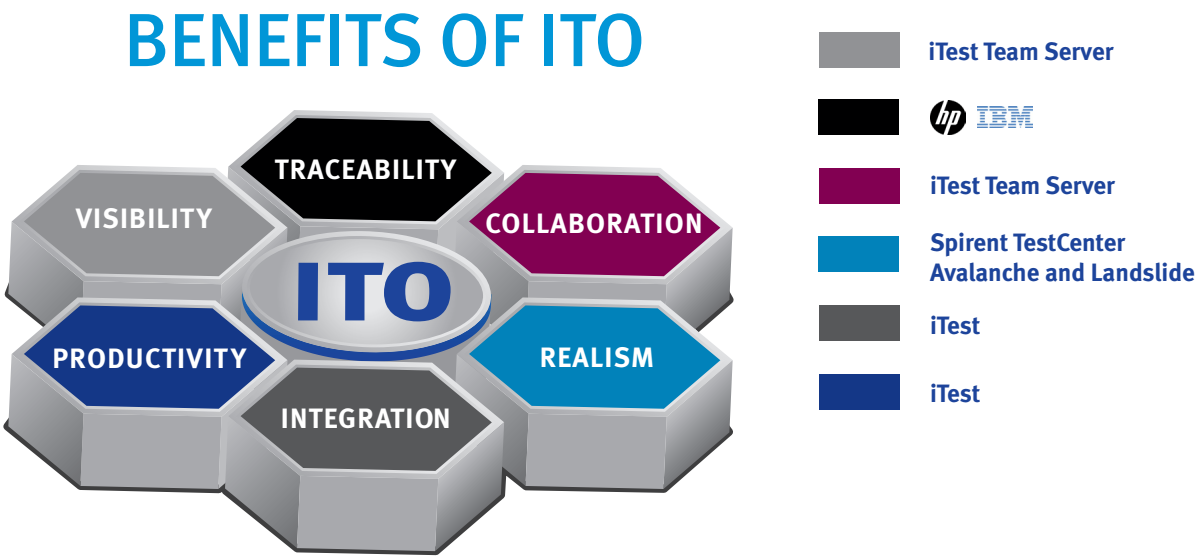

Figure 3

RECOMMENDATIONS

Communications infrastructure is the foundation for all applications and network services, even in virtualized and cloud computing environments. Today's businesses rely on that infrastructure in some way for nearly every business objective they have. This creates the need for the entire network infrastructure to have high levels of performance, availability, scalability and security. The only way to be sure these objectives are met is through comprehensive infrastructure testing, and the best way to address that is by using ITO.

The requirement for a high quality infrastructure is raising the importance of testing organizations throughout the communications industry. Development leaders must recognize this shift and give their teams the strategies and tools they need to perform infrastructure testing at the highest levels. By using ITO, development and test organizations can also identify opportunities to maximize test efficiency, mitigate risk and meet customer requirements, all while meeting deadlines.

In order to achieve the full benefits of ITO, test organizations must have the right tools and technology. Spirent offers a broad, integrated set of tools that support ITO practice areas including emulation and analysis, test automation, developer testing and lifecycle virtualization. These tools also deliver on the key ITO foundation benefits, including traceability, collaboration, integration, realism and methodology.


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