White Paper

ixia

Testing Enterprise WAN Applications

Ixia Network Emulator Best Practices

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Executive Overview

Poor enterprise application performance can cripple day-to-day business, affecting revenues directly through lost sales and indirectly through decreased productivity. Because of the increased complexity of systems and networks, it can be difficult to know how an application will perform on any given network or to identify the actual cause of performance issues when they arise. Performance expectations are often at variance to actual performance.

This white paper explains how to predict application performance and failure thresholds under every condition the system will encounter. It provides an overview of best practices for defining requirements and evaluating the system under consideration or development. Ixia supports these best practices by providing network emulation, analysis and reporting systems that establish a controlled environment for baseline and real-world performance testing.

Best Practices: Six steps to predicting application performance and failure thresholds

While it is apparent that performance metrics and failure thresholds must be known in advance of deployment, the best way to achieve this may not be clear. The following six-step best-practices process allows you to establish and document the capabilities and limitations of the application itself and the capabilities and limitations when deployed on the WAN.

The process is divided into two phases – baseline testing and network emulation testing. In each phase the process establishes the performance metrics and the failure thresholds of the application.

Phase	***Step***
Baseline	1. Create traffic profiles
	2. Establish performance metrics
	3. Establish failure thresholds (load)
Network Emulation	4. Create network profiles
	5. Establish performance metrics
	6. Establish failure thresholds (load and impairment)

By characterizing and validating that applications run properly over their network, organizations can significantly reduce their risks and improve end-user satisfaction.

Prerequisites

Service Level Objectives (SLO)

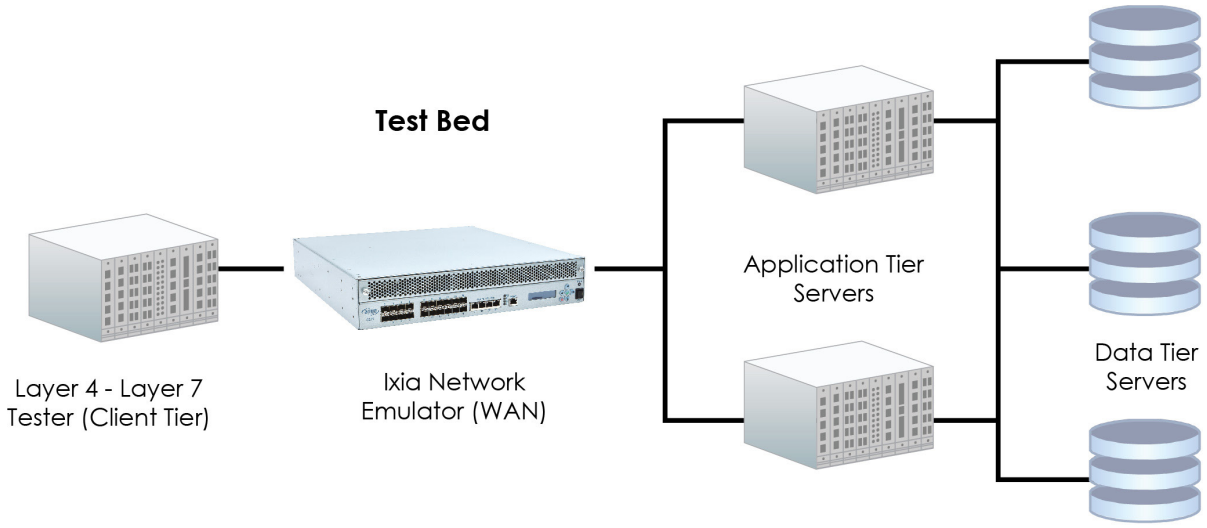
Service level objectives are a critical element of the application design process. They define the performance target for your application. SLO are typically expressed in terms of transaction response time and are established in cross-functional team meetings with the departments that will use the application. Metrics derived from testing are compared against SLO to determine if you are meeting your targets.

Test Bed

Consistency and repeatability are the foundation for meaningful testing and evaluation..

To evaluate your application, you must have a test bed that enables you to run controlled, repeatable tests. Consistency and repeatability are the foundation for meaningful testing and evaluation. Components of an application evaluation test bed include:

- ***Server-side infrastructure:*** The server side of the application, including the data tier, the application tier and any other server-side components in the solution, such as load balancers or firewalls.
- ***Network emulation:*** An Ixia Network Emulator that can be configured to create the delay, packet loss, reorder and errors that the application traffic will encounter when traversing the WAN, based on the profiles created in Step 4.
- ***Client-side infrastructure:*** A layer 4-7 tester that can generate application transaction traffic and emulate user behavior based on the profiles created in Step 1.



Emulate the WAN in the lab to find and fix problems before application deployment

Note: Actual PCs with script-based client software can be used as an alternative to the L4-L7 tester. However, it is difficult to create scripts that implement the load/behavior profiles. The resulting tests may not reflect realistic traffic loads and user behavior. In addition, the L4-L7 tester will have statistics gathering and reporting capabilities to report values such as transaction response time (TRT), transactions per second, timeouts and

retries. If you use PCs and application scripting, you must also create some method of reporting the performance metrics required to document the capabilities and limitations of the application. Manual operation of client PCs is not recommended because of the inability to efficiently scale to hundreds or thousands of users and the lack of repeatability during testing.

Phase One: Establishing the Baseline

As the first step in producing a realistic performance prediction, the baseline establishes how the application performs on a LAN with no congestion. During phase one, network emulation is not used. Phase one reveals the absolute maximum performance metrics and failure thresholds. This baseline provides information to decision makers for planning and budgeting. Once the application is deployed, management may ask for performance or response-time improvements. The baseline documents realistic best-case boundary expectations for the application.

Step 1: Create traffic profiles

To understand the performance of your application, you must first understand the nature of the user base. The application QA team studies the organization to assess periodic and event-driven usage and behavior, such as time-of-day variations, end-of-month/quarter/year demands and factors that may be unique to the organization or industry. The results form the basis of a set of traffic-load and user-behavior profiles that reflect the range of expected usage patterns. These profiles include the login storms that occur in the morning and after-lunch, typical usage with full attendance, and peak usage during crunch times, such as end-of-period reconciliation and reporting. The profiles are used to configure the layer 4-layer 7 test system, either dynamically or via scripts. The profiles are used during both phases of testing.

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Step 2: Establish baseline application performance metrics

Each load/behavior profile is used to generate application traffic. The analyzer gathers statistics from each test run. These metrics establish the application performance baseline for each profile, which is compared to SLO. The results could indicate a need to optimize the application before proceeding with more testing. An application that fails or barely passes SLO in an optimum network will not have acceptable performance across the WAN.

Step 3: Establish baseline load failure thresholds

An application can fail for many reasons. In this step of testing, the limits of the ability of the application to process traffic are identified. Failure threshold testing doesn't use typical load/behavior profiles. Instead, traffic loads are ramped up in steps and failure points (the level at which the performance metrics violate SLO) are identified. Threshold testing helps predict scalability limits and allows management to plan for growth, identifying points where investment in infrastructure will be required.

Phase Two: Emulate the network environment

Once the application achieves acceptable performance (TRT) and margins (failure thresholds), the next phase of testing begins. Each of the tests performed during the baseline phase are performed again under more realistic conditions.

Step 4: Create network profiles

The network team provides a set of network profiles that reflect the characteristics of each type of user. Delay and impairments, such as packet jitter, loss, reorder, modification and bit errors, will occur to varying degrees, depending on the network supporting each user. An on-site profile will have LAN speeds and minimal impairment, much like the unimpaired test bed used during phase one. A remote office profile will have WAN speeds and more impairment. A home office profile might have broadband access speeds and delays for VPN security. A mobile user may have a variety of connection options, including dialup, either directly into the company network or to a provider and then via VPN, or broadband with VPN.

Network emulation testing can mean the difference between a smooth network application deployment and an unexpected crisis.

Step 5: Establish realistic application performance metrics

Each test run in Step 2 is run again, now against each network profile. The metrics reported from each test are compared to SLO to verify that the application can still deliver acceptable performance under the expected network conditions. Violations of SLO are subjected to troubleshooting to determine the root cause and remedial measures.

Step 6: Establish realistic load and impairment failure thresholds

During network emulation testing, two types of failure thresholds are established. As during the baseline phase, traffic load thresholds are measured, but during network emulation testing they are established for each network profile. The results are compared to the baseline thresholds to right-size scalability limits for future growth. In addition, impairment thresholds are identified. Network delay and impairment settings are ramped up in steps, and failure points due to network conditions are identified. Network impairment threshold testing helps identify the service level agreement terms required from WAN vendors to assure acceptable application performance for remote users.

Each step of application readiness testing provides valuable information for design review, application optimization, strategic and tactical planning, budgeting, level-setting of expectations, reporting to management, and troubleshooting.

Conclusion

Enterprise applications are essential elements of the business infrastructure. Poor application performance can cripple day-to-day business and affect productivity. The complexity of enterprise applications and networks makes it difficult to predict application performance and identify the root cause of performance issues.

The key to a successful application rollout is robust testing under realistic traffic and network conditions. The two-tier testing model of establishing baseline and network emulation metrics and determining load and impairment thresholds empowers you to compile the data you need to make informed decisions and communicate realistic expectations vertically and horizontally through your organization.

Ixia Network Emulators are essential tools for effectively developing and deploying enterprise applications. They provide the ability to:

- Increase the quality of the user experience
- Accurately and precisely emulate real-world network conditions prior to deployment
- Reduce development schedules and support cost
- Minimize troubleshooting and downtime on the production network
- Increase revenue and competitive advantage

Network emulation testing can mean the difference between a smooth network application deployment and an unexpected crisis. By applying these best practices in an authentic network environment, you can ensure a successful rollout.

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