

# Citrix NetScaler Application Delivery Controller (ADC)

## Real-World Application Delivery Performance Evaluation versus F5 Networks

### EXECUTIVE SUMMARY

True, measurable performance is a key factor when selecting an Application Delivery Controller (ADC) solution for modern data centers, but with so many different functions available in an ADC, it is important to understand the actual performance in real-world scenarios. While many traditional load balancers and ADCs use special hardware, Citrix opted for a software first approach that uses standard Intel hardware with specialized software that can be easily virtualized as a basis for its NetScaler ADC.

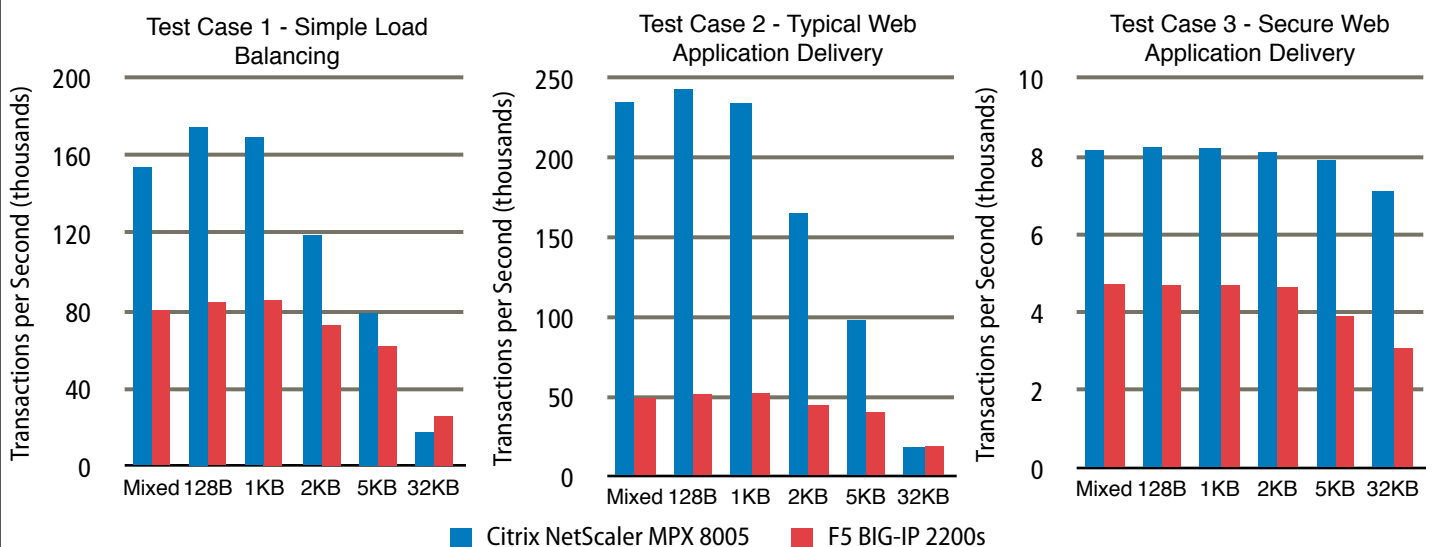
Citrix commissioned Tolly to evaluate the performance using common configurations of several NetScaler models along with comparable products from F5 Networks' BIG-IP line of ADC solutions in scenarios designed to simulate real-world use. Tolly found NetScaler provided up to 480% the performance of the F5 models. ... <continued

### THE BOTTOM LINE

Citrix NetScaler Application Delivery Controllers deliver:

- 1 Up to 4.8X the performance of F5's BIG-IP in real-world testing scenarios
- 2 More consistent performance as more features are enabled
- 3 Significantly better performance when scaling multi-tenant/multi-instance configurations

**Platform Test 1: Citrix NetScaler MPX 8005 vs F5 BIG-IP 2200s**  
ADC Transaction Performance, 2 Bonded 10GbE Links, Various Response Sizes  
(as reported by Ixia IxLoad 6.40)



Notes: Ixia settings: 21 connections per IP, 1 transaction per connection. Each DUT configured with 72 virtual servers. The NetScaler 8005 and the F5 2200s both connected to a Cisco router to supply test traffic. Mixed response size proportions defined in Table 2. See Test Methodology section for details

Source: Tolly, March 2014

Figure 1



For the choice of platforms, a range across the typical enterprise setup was chosen. Four F5 models were chosen and the closest in the price range for the advertised requests per second were selected. See Table 1 for details of all systems under test. For additional background on scenarios and platform selection, see sidebar: "Understanding ADC Deployment Scenarios and Citrix/F5 Platform Comparisons."

### Deployment Scenarios

In order to provide a broad and realistic basis for comparison, three different test scenarios were run for each pair of competing solutions. And, in all cases, performance was benchmarked across a range of very small to very large response sizes. See Test Methodology section for additional details.

### Simple Load Balancing

This scenario was designed to demonstrate simple layer 4 (L4) load balancing functionality. The test focused on performance of ADCs when running basic load balancing with cookie persistence, logging and source IP preservation.

### Typical Web Application Delivery

This scenario was designed to exercise a real-world, layer 7 (L7) feature set that would be typical of Internet Web application traffic. Features such as connection logging and cookie inserts and header inserts and rewrites.


### Secure Web Application Delivery

This scenario was the same as the prior scenario with the addition of secure socket layer (SSL) to provide session security.

Citrix Systems, Inc.

**NetScaler MPX and SDX Application Delivery Controllers**

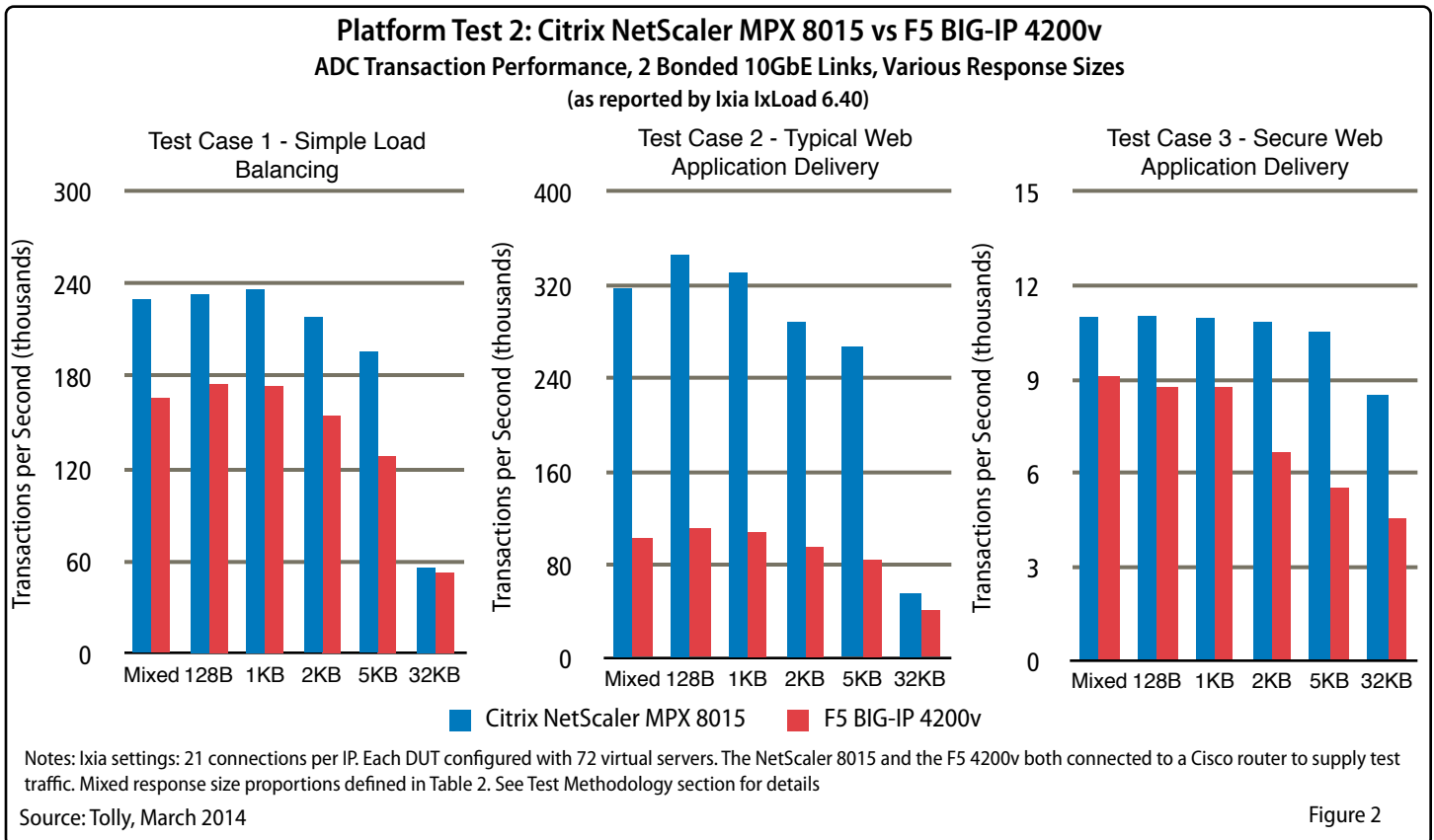
**Real-World ADC Performance**



*Tested January-March 2014*

### Entry Mid-Level Systems

The Citrix NetScaler MPX 8005 was benchmarked vs. the F5 BIG-IP 2200s. The Citrix NetScaler outperformed the F5 BIG-IP in every response size in all three scenarios. On average, for scenario 1 Citrix performance was 59% better, for scenario 2





Citrix was 253% better - or 2.5X that of F5. And, for scenario 3, Citrix averaged 88% better than F5. See Figure 1.

### Mid-Level Systems

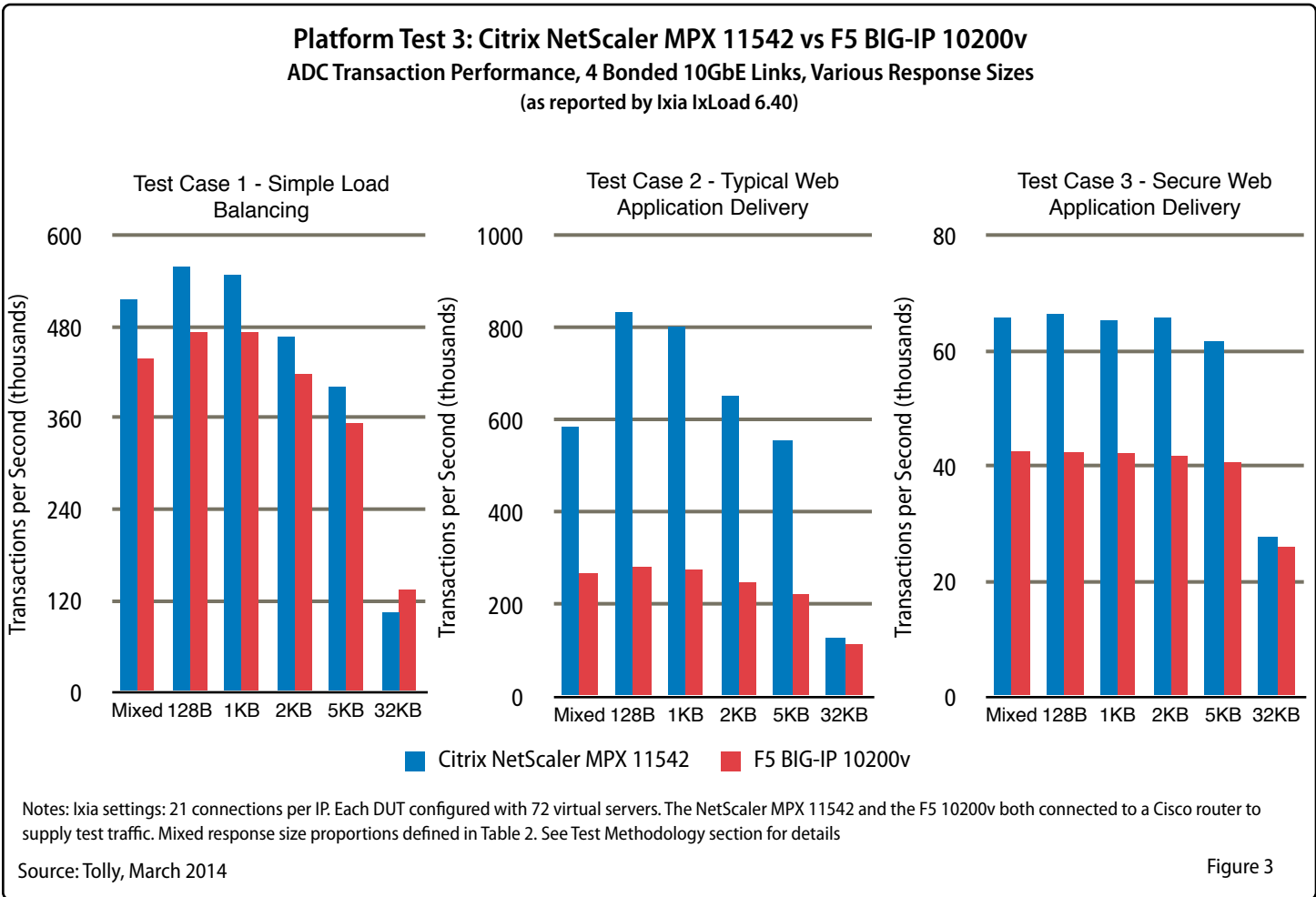
The Citrix NetScaler MPX 8015 was benchmarked vs. the F5 BIG-IP 4200v. Again, the Citrix NetScaler outperformed the F5 BIG-IP in every response size in all three scenarios. On average, for scenario 1 Citrix performance was 35% better, for scenario 2 Citrix was 180% better - or 1.8X that of F5. And, for scenario 3, Citrix averaged 52% better than F5. See Figure 2.

### Data Center Mid-Level Systems

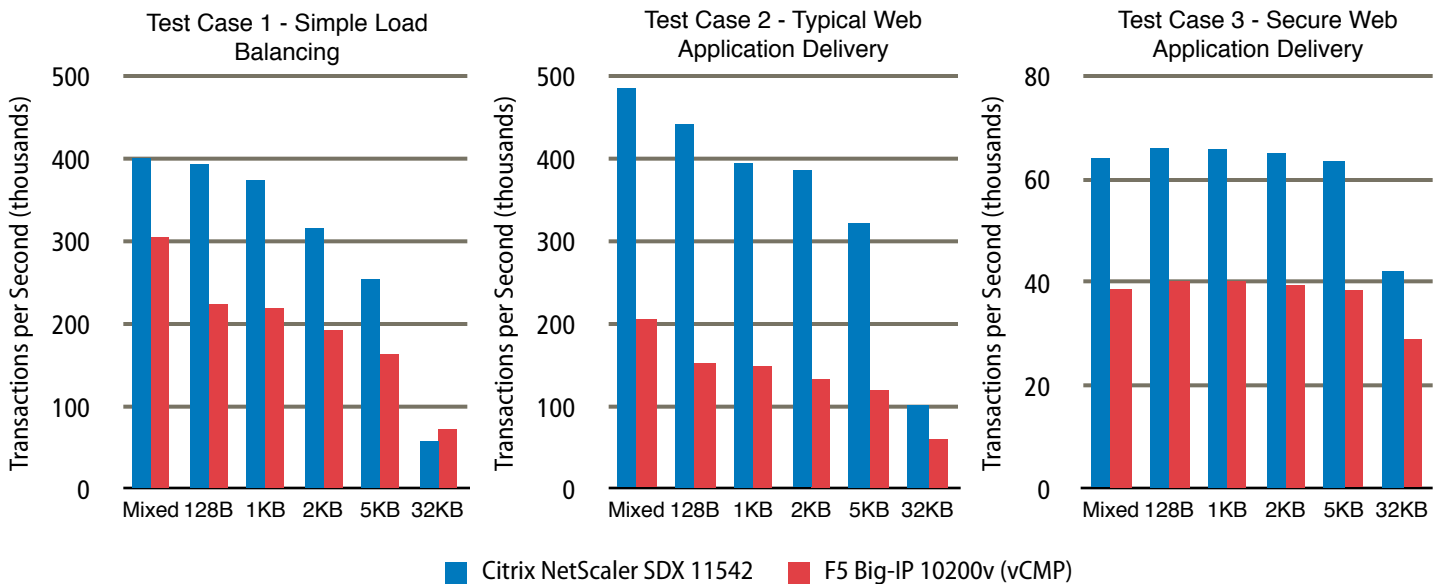
The Citrix NetScaler MPX 11542 was benchmarked vs. the F5 BIG-IP 10200v. The Citrix NetScaler outperformed the F5 BIG-IP in every response size except 32KB in scenario 1. On average, scenario 1 Citrix performance was 9% better, scenario 2 Citrix was 139% better. And, for scenario 3, Citrix averaged 47% better than F5. See Figure 3.

### Higher-End Multi-Tenant Systems

The Citrix NetScaler SDX 11542 was benchmarked vs. the F5 BIG-IP 10200v with vCMP enabled. Four ADC instances were configured on each system. The Citrix NetScaler outperformed the F5 BIG-IP in every response size except 32KB in scenario 1. On average, in scenario 1, Citrix performance was 46% better, in scenario 2, Citrix was 153% better. And, for scenario 3, Citrix averaged 61% better than F5. See Figure 3.



**Platform Test 4: MultiTenant Performance : Citrix NetScaler SDX 11542 vs F5 BIG-IP 10200v-vCMP**  
**Aggregate ADC Transaction Performance, 4 Bonded 10GbE Links, Various Response Sizes on Four Shared Instances**  
 (as reported by Ixia IxLoad 6.40)



Notes: Ixia settings: 21 connections per IP. Each DUT configured with 72 virtual servers. The NetScaler SDX 11542 and the F5 10200v both connected to a Cisco router to supply test traffic. Mixed response size proportions defined in Table 2. See Test Methodology section for details  
 NetScaler SDX 11542 configuration consisted of four provisioned instances with (5,3,1,1) vCPUs, respectively. F5 configuration consisted of four instances with (6,2,2,2) provisioned vCPUs, for totaling 12 vCPUs. F5 does not allow provisioning odd number of cores to instance. Traffic was divided proportionally across instances.

Source: Tolly, March 2014

Figure 4

## Test Setup & Methodology

### Test Environment

The test environment consisted of two Ixia XT80-V2 appliances with software release 6.40.0.527 to host four or six client ports and four server ports. The Ixia profiles were configured such that there were 21 connections per client IP, with 10 transactions per connection for HTTP tests, and 1 transaction per connection for HTTPS. The 10 total ports were connected to a Cisco 3064-X switch, splitting the client

and server traffic to VLANs 101 and 102, respectively.

For the tests involving the F5 BIG-IP 2200s and 4200v, as well as the Citrix MPX 8005 and MPX 8015, a port group consisting of two links was configured to carry tagged VLANs 101 and 102. For the higher capacity NetScaler MPX-11542 and F5 Big-IP 10200v, this port group consisted of 4x 10GbE links.

Ixia tests were configured for each test case with response sizes of: 128B, 1KB, 2KB, 5KB, 32KB, and a mixed response size test, which consisted of a mix of traffic outlined in Table 2 below.

All DUT software current as of February 14, 2014. The Citrix devices were all running SW version 10.1, build 124.10, while each F5 BIG-IP device was running BIG-IP 11.4.1 build 608.

The ADC testing consisted of three primary test cases, each of which was chosen to emulate real-world configurations.

### Simple Load Balancing

For this test case, each DUT was configured with 1 virtual server and 72 services or pool members. The goal of this test case was to closely emulate typical load balancing scenarios. The content switching policy was configured generally for a URL containing "/". USIP was enabled to preserve source IP



### Solutions Under Test: Vendor-Advertised Performance Claims

Product Class	Citrix NetScaler				F5 BIG-IP			
	Device	SRP	SSL TPS (2K)	HTTP RPS	Device	SRP	SSL TPS (2K)	HTTP RPS
Entry Mid-Level Systems	MPX 8005	\$25,000	6,500	380,000	BIG-IP 2200s	\$27,995	4,000	425,000
Mid-Level Systems	MPX 8015	\$48,000	9,000	1,000,000	BIG-IP 4200v	\$41,995	9,000	850,000
Data Center Mid-Level Systems	MPX 11542	\$95,000	45,000	2,700,000	BIG-IP 10200v	\$94,995	42,000	2,000,000
Higher-End Multi-Tenant Systems	SDX 11542	\$140,000	45,000	2,700,000	BIG-IP 10200v (Best Package)	\$148,995	42,000	2,000,000

Note: Pricing from sparco.com website, may vary and is used here only to establish that systems are in comparable price ranges. Pricing is in US dollars. Performance information from relevant vendor data sheets. Not verified by Tolly.

Table 1

address, as was persistence via cookie insert. Additionally, each DUT was set to log each action taken for each connection and request.

#### Typical Web Application Delivery

The configuration for test case two was meant to emulate a typical web application configuration. Like Test Case 1, cookie insert and connection logging was enabled for each device. Additionally, a Request insert (X-Forwarded-For) was used to preserve source IP address. To remove information that can be valuable to hackers, a response

delete (X-Powered-By), and response rewrite (replaced server header) were configured.

#### Secure Web Application Delivery

While the feature configuration for test case three was identical to test case two, 2048-bit SSL encryption was activated for the virtual servers.

#### Multi-Tenant Configuration

For tests of the Citrix NetScaler SDX 11542 and the F5 BIG-IP 10200v with vCMP,

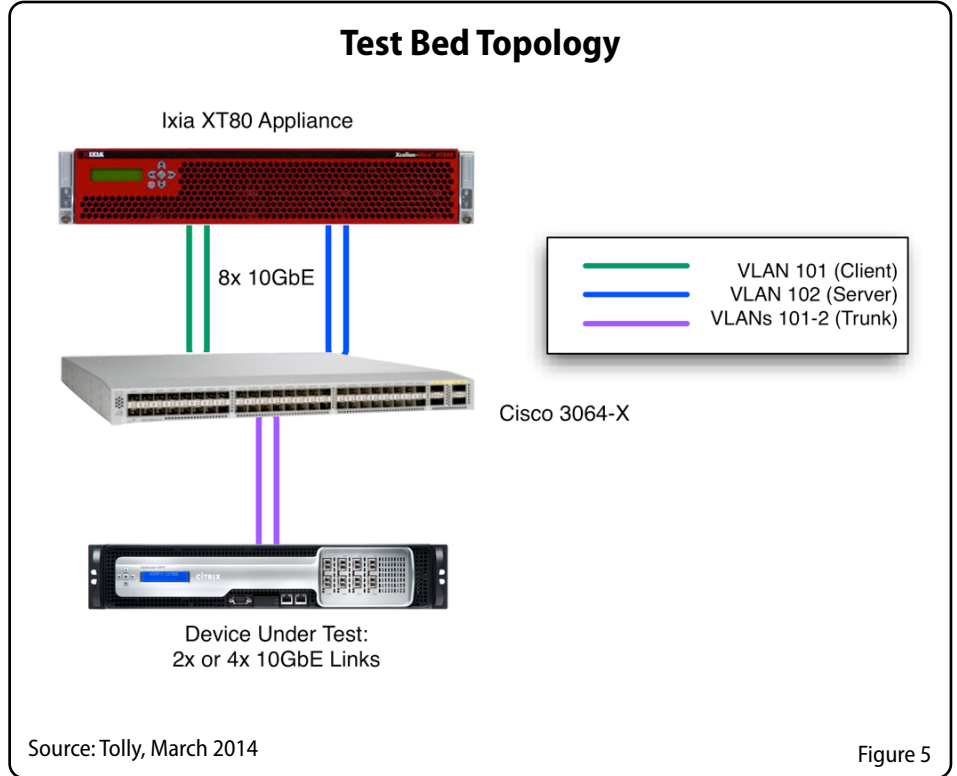
several virtual instances were provisioned on the appliances.

The goal was to provision four total instances, one large, one medium, and two small. For the SDX 11542, this was achieved by provisioning instances with 5, 3, 1 and 1 vCPUs, respectively. F5 only allows provisioning of vCPUs in pairs, and allows at most 6 vCPUs (3 cores) to be assigned to a single instance, thus restricting the device configuration given the twelve total vCPUs. Therefore, engineers configured one instance with six vCPUs, and the remaining three instances with 2 vCPUs.

IxLoad was then configured with additional client networks, which would target each of the provisioned instances with a traffic load proportional to that of the vCPU counts.

## Test Procedure

For each test case, IxLoad was configured to ramp up for 30 seconds, and hold a steady-state for 90 seconds, a total of two minutes per test run. Engineers tuned the target transactions per second to sufficiently load the system, without creating too many concurrent connections. Due to the nature of the testing, the devices occasionally became overrun with requests, causing an increase in response time and a minute decrease in the transaction rate. In these cases, reported results calculated from the steadiest interval during the test, as opposed to a total average over the run duration.




Mixed Payload Proportions	
128 Byte	51.67%
1 KB	29.01%
2 KB	17.43%
5 KB	1.5%
32 KB	0.39%

Source: Tolly, March 2014      Table 2

### Test Equipment Summary

The Tolly Group gratefully acknowledges the providers of test equipment/software used in this project.

Vendor	Product	Web
<b>Ixia</b>	<b>Ixia Xcellon-Ultra XT80-V2 Software: IxLoad 6.40.0.527</b>	 <a href="http://www.ixiacom.com">http://www.ixiacom.com</a>

## Understanding ADC Deployment Scenarios and Citrix/F5 Platform Comparisons

### Deploying ADCs

With the many tasks that ADCs perform today, having tests that map to real world usage rather than legacy layer 4 load balancing is important. While load balancing is still the main feature used, features such as “connection logging” for security and compliance, source IP preservation so the end server knows who the client is and “cookie persistence” to ensure that the persistency of a client with a server are equally important.

Content switching enables load balancing decisions based on content in request headers and bodies. It enables configuring different backend server pools to “specialize” in the content they deliver and the tasks they perform. For example, one server pool for mobile browsers and a separate one for desktop browsers. This type of setup is typically used for example in a Cisco ACE setup and so is the basis for test case one.

For publicly-accessible web sites, there are other standard features that come into play such as removing information about the back end servers from headers that give useful information to hackers. Also, client IP addresses are frequently inserted into requests by the ADC to provide a way for the backend application to maintain client visibility. This typical Web setup is used for test case two. Lastly, more and more traffic is now encrypted and secured using transport layer security and so for test case three, SSL is added.

Response size is also a metric that effects performance, and so a range of response sizes were tested. Based on Google’s report on Web metrics (<https://developers.google.com/speed/articles/web-metrics>), the median is around 2KB with less than 20% of traffic being above 8KB. Given the Google data on response size distribution, with a mean of 7.19KB and a skewed left distribution, each test case has a mixed payload test with a mean of about 7KB, and a skewed left distribution. Five fixed response sizes were tested as well.

Metric	Mean	Min	10	20	30	40	Median	60	70	80	90	Max
KB Per Get	7.19	0.00	0.43	0.63	0.92	1.31	1.93	2.90	4.38	7.96	18.46	35,932.9

### Choice of Platforms and Platform Comparison

For the choice of platforms, a range across the typical enterprise setup was chosen. Four F5 models were chosen and the closest in the price range for the advertised requests per second were selected. (Note that the F5 4200v has a higher requests per second capacity than the 5000s and the 5200v was significantly more expensive.)

The entry level standard edition from Citrix was chosen against the LTM edition from F5. The exception was the NetScaler SDX 11542 platinum which was compared to the 10200v Best package.

As companies move to a greater virtualization in the datacenter, being able to have a platform that runs multiple instances of the ADC is becoming ever more important. In fact Citrix has stated that NetScaler SDX multi-tenant platforms sales are growing faster than the standard MPX platform. The multi-tenant SDX 11542 was compared against the 10200v with vCMP enabled.

Source: Citrix Systems, Inc.



## About Tolly

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## Interaction with Competitors

In accordance with Tolly's Fair Testing Charter, Tolly personnel invited representatives from F5, Inc. to participate in the testing. After initial discussion, F5 declined to participate.

For more information on the Tolly Fair Testing Charter, visit:

<http://www.tolly.com/FTC.aspx>



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