

Lab Testing Summary Report

December 2007
Report 0701215

Product Category:
**Network Optimization
Appliances**

Vendors Tested:
**Cisco Systems
Riverbed Technology**

Products Tested:
Cisco WAE 7371

**Riverbed Technology
Steelhead 6020**

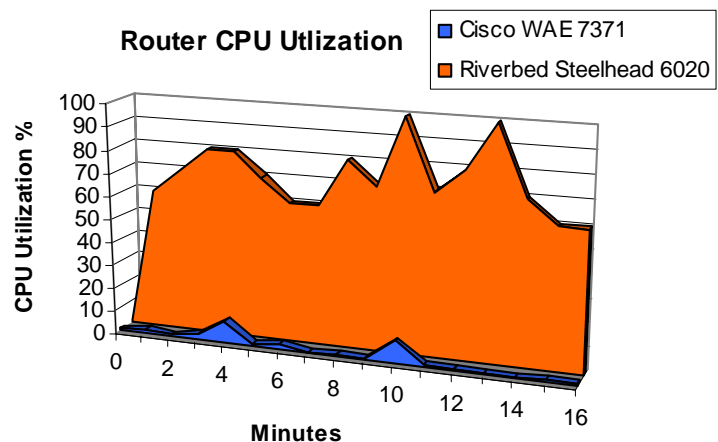


Cisco WAE 7371 Test Summary:

- Superior performance and scalability proven with tests exceeding 50,000 HTTP connections at 350 cps
- Load reduction measured up to 89% for remote data center servers proven in testing
- Rock solid stability and reliability demonstrated even after completing an aggressive battery of load tests
- Consumes considerably less power, rack space, and cooling resources than competitive products

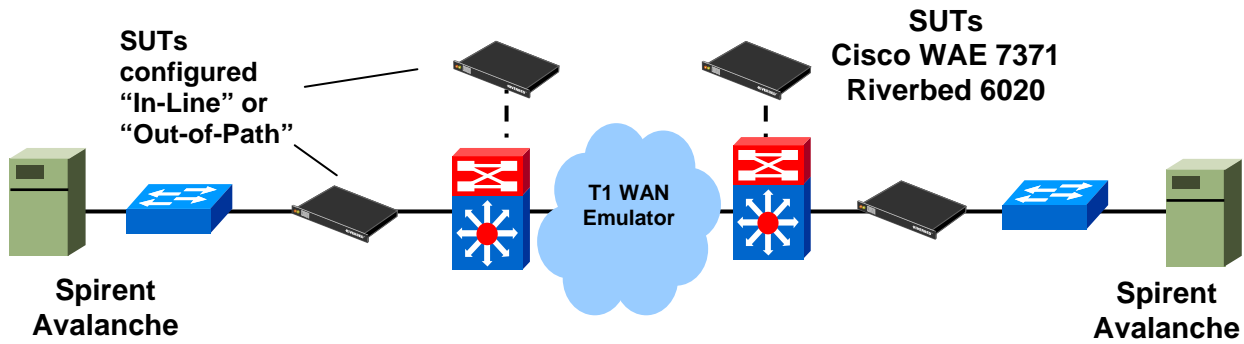
Cisco Systems submitted the Cisco WAE 7371 network optimization appliance to be competitively assessed in areas of scalability, performance, environmental and reliability. This report includes a comparison of the Cisco WAE 7371 and the Riverbed Steelhead 6020. A comprehensive battery of tests were applied to both products that examined well beyond the typical “drag race” performance metrics presented in less sophisticated analyses that have been conducted to date. This testing examined the impact the appliances have on the underlying network including network switch CPU utilization, server utilization, as well as the environmental aspects of power and heat dissipation.

Although both products evaluated demonstrated an excellent ability to optimize traffic under lightly loaded conditions during these tests, the impact they have on switch CPU utilization became apparent in moderate load conditions when devices were configured in an “Out-of-Path” configuration. The Riverbed Steelhead 6020 consumed an unacceptably high amount of CPU utilization whereas the Cisco WAE 7371 could take advantage of hardware acceleration in the



“Less is more” - reduced strain on network infrastructure – Cisco WAE 7371 consumes significantly less CPU resources from the routed network than the Riverbed Steelhead 6020 while conducting “Out-of-Path” performance tests

Test-bed Setup



Devices Under Test and Test Tools:

- (2) Cisco WAE 7371 - WAAS version 4.0.13.b.23
- (2) Riverbed Steelhead 6020 - RiOS version 4.1.0b e
- Spirent Avalanche version 7.5.4 build 44864
- Shunra Storm VE Network Appliance version 5.2 build 65.1.22
- (2) Cisco Catalyst 6503 Switches: WS-C6503-E, 12.2(18)SXF10, WCCPv2

Test-bed Description:

Systems under test (SUTs) were connected as shown above in either an “In-Line” or “Out-of-Path” configuration. A Spirent Avalanche test system was utilized to generate end-to-end HTTP connection traffic across the L3 network and the T1 WAN simulated by a Shunra Storm WAN emulator. An open source benchmark tool for Microsoft Office applications was used to script and measure response times for basic Microsoft Office application file operations in the series of tests. Benchmark executes a scripted set of operations and measures the time, which is a good indication of the expected user experience on the network.

“Out-of-Path” Test / WCCP Test: SUTs were configured in an “Out-of-Path”/WCCP configuration (see diagram above). HTTP session traffic tests were conducted up to 350 connections per second while downloading of a 512 KB file using Microsoft IIS Server, (Internet Explorer client). Measure Catalyst Switch CPU utilization

“In-Line” Connections Test: SUTs were configured in an “In-Line” configuration (see diagram above). Conduct HTTP session traffic tests up to 110% of the rated connection per second and simultaneous connection handling capacity of the appliances. Verify with Avalanche set to HTTP downloads of a 512 KB file from a Microsoft IIS Server, (Internet Explorer client). Connections set to time out after 300 seconds. Test up to 50,000 connections for Cisco WAE 7371 and 40,000 connections for Riverbed Steelhead 6020. Avalanche ramp up was set to 300 seconds.

File Services and Server Utilization Test (CIFS): The CIFS (Common Internet File System) tests measured the speed performance of the appliances ability to accelerate common Microsoft file services such as file opens, closes, and changes. This test measured the performance improvement the Network Optimization Appliances provided for CIFS operations, as well as measured the impact on data center server utilization and network load.

Note: Each vendor’s publicly available materials were utilized in the analysis and conduct of testing to produce this report. The technical expertise of the test engineers were applied to ensure the vendors’ units were properly configured. Riverbed Technology declined invitation to provide input for this testing and was extended invitation to retest their product.

Catalyst 6503 Switches to offload CPU utilization.

A series of five test and assessment areas were included in the evaluation. The areas consisted of: Scalability and Performance “Out-of-Path”, Scalability and Performance “In-Line”, Server Utilization, Reliability, and Environmental.

“Out-of-Path” / WCCP Test Performance

The first page graphic shows the impact of

router CPU utilization using both products during Scalability and Performance “Out-of-Path” testing. The Cisco WAE 7371 as well as any acceleration product that complies with Cisco’s open standard Web Caching Control Protocol can take advantage of the available hardware acceleration provided by the Catalyst Switches. **Web Cache Control Protocol (WCCP)** is a published open standard from Cisco, which provides for enhanced performance using the switch’s hardware. In the test bed the SUTs were connected to the router in an “out-of-path” configuration (see test bed

diagram previous page) and the optimization performance was measured for establishing HTTP sessions. A load of 300 connections/sec was applied using a 512 KB file.

With minimal load on the switch's CPU, resources the Cisco WAE 7371 proved it was able to optimize the full load of HTTP connections. The Cisco WAE 7371 sustained over 300 connections/second with up to 50,000 connections with minimal CPU load on the switch in the network. The Riverbed Steelhead 6020; however, in the same test could only optimize a fraction of the traffic applied under heavy load conditions and consumed more than 90% of the switch's CPU utilization.

"In-Line" Connections Test Performance

The devices under test were reconfigured in an "In-Line" mode, the second common configuration for these types of appliances. This test measured the ability to achieve rated HTTP traffic connection per second and simultaneous connection handling capacity of the appliances. Loads were applied for 50,000 connections for the Cisco WAE 7371 and 40,000 for the Riverbed Steelhead 6020. The Cisco WAE 7371 passed all in-line scalability tests.

The Riverbed Steelhead 6020 could not

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Telnet 171.68.96.249
bob-dc#sho stat tfo
Total number of optimized connections      : 50082
No. of active connections                  : 50000
No. of pending (to be accepted) connections : 0
No. of connections closed normally         : 0
No. of connections closed with error       : 82
Total number of peers                       : 1
No. of entries into overload mode          : 8
No. of connections reset due to -
  Socket write failure                      : 0
  Socket read failure                      : 0
  Opt socket close while waiting to write  : 0
  Unopt socket close while waiting to write : 0
  Opt socket error close while waiting to read : 66
  Unopt socket error close while waiting to read : 0
  DRE decode failure                       : 0
  DRE encode failure                       : 0
  Connection init failure                  : 0
  Opt socket unexpected close while waiting to read : 0
  Exceeded maximum number of supported connections : 1
  Buffer allocation or manipulation failed  : 0
  Peer received reset from end host        : 15
  DRE connection state out of sync         : 0
bob-dc#sho stat tfo
  
```

Cisco WAE 7371 Sustains 50,000 HTTP Sessions while providing "In-Line" optimization

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Telnet 171.68.96.249
C 10.100.0.8 50745 10.100.1.8 80 2007/11/06 01:11:15
C 10.100.0.8 50750 10.100.1.8 80 2007/11/06 01:11:15
C 10.100.0.8 50752 10.100.1.8 80 2007/11/06 01:11:15
C 10.100.0.8 50758 10.100.1.8 80 2007/11/06 01:11:15
C 10.100.0.8 50761 10.100.1.8 80 2007/11/06 01:11:15
C 10.100.0.8 63204 10.100.1.8 80 2007/11/06 01:09:19
C 10.100.0.8 63200 10.100.1.8 80 2007/11/06 01:09:15
C 10.100.0.8 63539 10.100.1.8 80 2007/11/06 01:09:35
C 10.100.0.8 63184 10.100.1.8 80 2007/11/06 01:09:43
C 10.100.0.9 55956 10.100.1.8 80 2007/11/06 01:09:42
C 10.100.0.9 61593 10.100.1.8 80 2007/11/06 01:11:15
C 10.100.0.9 61783 10.100.1.8 80 2007/11/06 01:11:14
C 10.100.0.9 62788 10.100.1.8 80 2007/11/06 01:11:15
Established Optimized (O): 11483
Half-Opened Optimized (H): 0
Half-Closed Optimized (C): 116
Pass Through (P): 46138
Forwarded (F): 0
Discarded (not shown): 0
Denied (not shown): 0
Total: 57737
  
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Riverbed Steelhead 6020 fails to achieve 40,000 simultaneous sustained HTTP connections

achieve the desired load capacity. The device would failover to pass-thru mode for nearly all connections when attempting to sustain 40,000 connections.

File Services and Server Utilization Test

In the file services testing, the SUTs were placed in an In-Line configuration. An open source test script was used to replicate Microsoft file services', file opens, closes, and changes. Different file types were sent and received using the Common Internet File System (CIFS) protocol.

The tests conducted looked not only at the performance improvement for the CIFS operations (time and WAN bandwidth reductions) but also the associated impact on server utilization and local network load.

Both products tested demonstrated an excellent ability to improve CIFS operation performance ranging from a 60 to 80% application response

Network Utilization % Improvement

Cisco WAE 7371		Riverbed Steelhead 6020		No optimization appliance	
OUT:	IN:	OUT:	IN:	OUT:	IN:
2.16 MB	23.8 MB	39.3 MB	23.9 MB	20.5 MB	24.3 MB
89%	2%	<92%>	2%	n/a	n/a

Cisco WAE 7371 provides reduction of network and server load for data center servers, whereas competitive products may actually worsen the network

time improvement. A key differentiator noted was that the Cisco WAE 7371 reduced the server network load by 89%, whereas the Riverbed product doubled the amount of data required to be generated by the server.

Organizations implementing network optimization solutions should consider the additional server resources required in deploying these solutions and avoid unfriendly and expensive data center solutions.

Reliability Analysis

During the conduct of the testing the Cisco WAE 7371 was found to be reliable and exhibited no signs of system instability or system lock up.

The Riverbed Steelhead 6020 however exhibited multiple repeatable instances of issues including: system false alert notifications, system instability, and system crashes with heavy load. Of particular concern, when the load applied was removed the device could not

to heavily loaded enterprise network.

The problems exhibited with the Riverbed Steelhead 6020 were very surprising; however, they were repeatable despite firmware upgrade and different/multiple hardware platforms.

Environmental Analysis

The Cisco WAE 7371 solution is a lean, green machine. It has greater service density while consuming less power and cooling costs, thereby providing TCO advantages compared to the Riverbed Steelhead 6020.

	Cisco WAE 7371	Riverbed Steelhead 6020
Size	2 U	3 U
Heat dissipation	4350 BTU / hour max	5900 BTU / hour max
Watts consumed	2 x 415 830 Watts	3 x 380 1140 Watts

The Riverbed Steelhead 6020 consumes 37% more power than Cisco WAE 7371

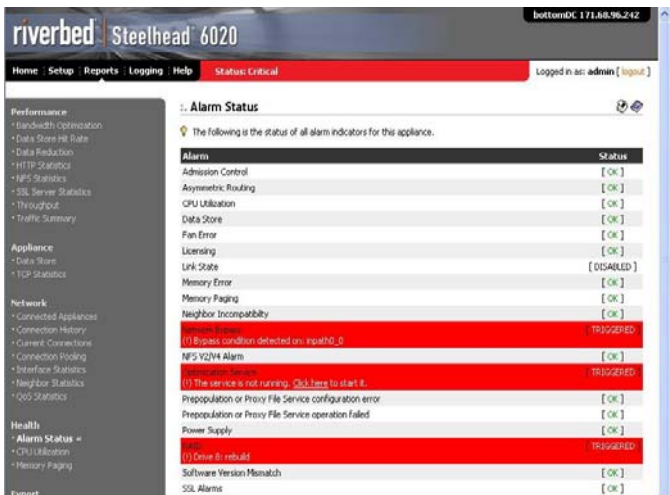
The Cisco WAE 7371 network optimization appliance consumes 27% less power, 33% less rack space, and 1,550 less BTUs/hour for cooling than Riverbed Steelhead 6020 competitive product.

The above calculations rely on each vendor's own published power consumption rating for the device tested.

Test results applicability

As network environments may be radically different for each deployment, we recommend custom predeployment testing before applying any product to a production network. Miercom offers objective vendor independent pre-deployment testing services.

Contact Miercom for available updates on test results for the products tested included in this report or other related network optimization products or technology.



Riverbed Steelhead 6020 exhibited numerous instances of system instability during testing, even with traffic load well under the rated capacity of the appliance.

recover by itself nor resume normal operation without a hard power reboot of the system.

All test loads were within the published specified capacity of the products. Our intent was not to conduct kill tests on the products, but replicate usage expected for a moderately

Miercom Performance Verified Seal of Approval

Based upon extensive validation testing focused on performance, system scalability and reliability the Cisco WAE 7371 Network Optimization Appliance clearly meets its specifications, capabilities, and will exceed customer expectations. The Cisco WAE 7371 has proven its effectiveness and resiliency and thereby earned the Miercom Performance Verified™ Certification.



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