TEST REPORT

Tolly.

#212128

September 2012

Commissioned by
Ubiquiti Networks, Inc.

Ubiquiti Networks EdgeRouter Lite

Gigabit Ethernet Routing Performance Evaluation Versus MikroTik RB1100AHx2

EXECUTIVE SUMMARY

Ubiquiti Networks' EdgeRouter Lite offers unprecedented price/performance value, providing more than 25X higher performance per dollar than the MikroTik product compared in this report. With the combination of its broad feature set, advanced hardware platform, and disruptive price the EdgeRouter Lite is positioned to bring enterprise-class performance to a much wider audience.

Ubiquiti Networks commissioned Tolly to evaluate the packet forwarding performance of its new EdgeRouter Lite product and compare that to a similar product from MikroTik. Tests showed that the EdgeRouter Lite priced at $99 performed significantly better than the competing device that costs around $475. See Figure 1. ...<continued on next page>

THE BOTTOM LINE

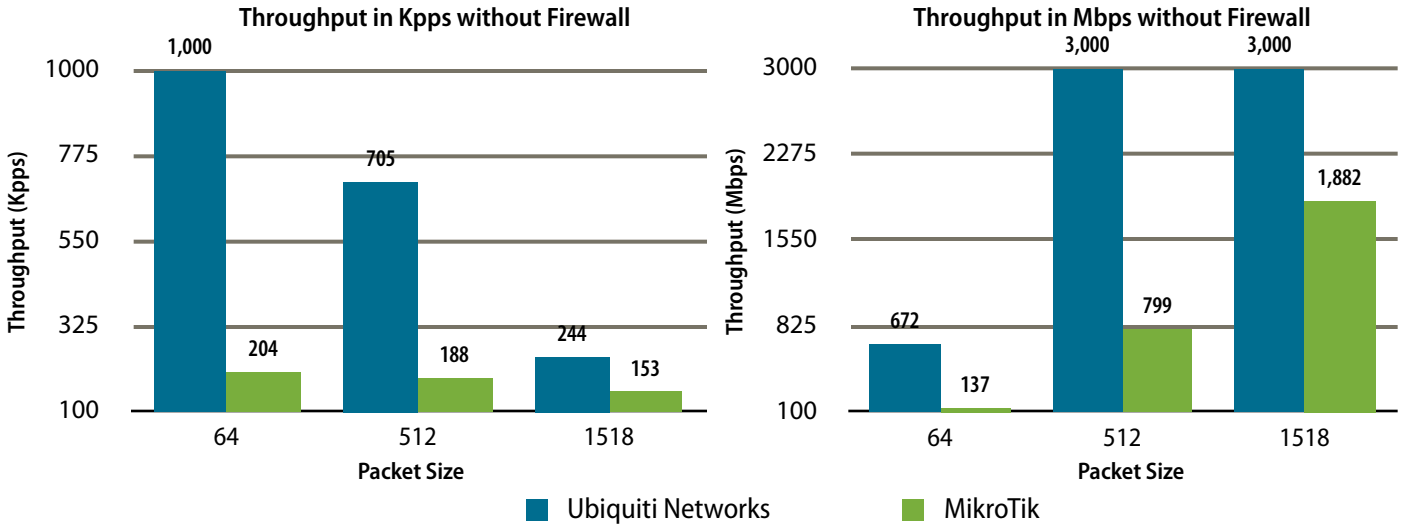
The Ubiquiti EdgeRouter Lite:

1. Forwards 1 million packets per second of 64-byte packets
2. Forwards at line rate (3Gbps) across three ports with 512-byte packets or higher
3. Maintains consistent, high performance even with firewall functionality
4. Provides 29X more Kpps per USD than MikroTik on average

Layer 3 Bidirectional Gigabit Throughput Without Firewall in Mbps and Kpps

As reported by Spirent TestCenter

(Higher values are better)



Note: All products tested using three GbE ports on each DUT. Spirent throughput metrics include 12-byte Ethernet inter-frame gap (IFG).

Source: Tolly, June 2012

Figure 1

The MikroTik product tested was the RouterBoard RB1100AHx2, which has a 1U rackmount form factor, three Gigabit Ethernet ports and ten switched GbE ports (in two groups). For customers not requiring switched ports in a router, the Ubiquiti Networks EdgeRouter Lite provides high-performance, low- latency IP routing at an extremely low price.

When results are analyzed in terms of how many thousand packets per second (Kpps) of throughput are delivered per dollar of cost, Ubiquiti Networks delivers 10.10 Kpps/USD compared to between 0.43 and 0.29 for the MikroTik. The EdgeRouter Lite results are 29X more than MikroTik.

Test Results

Performance

Tolly engineers tested the performance of both solutions under test with and without firewall functionality at three packet sizes, 64-byte, 512-byte and 1518-bytes. Throughput was measured in Mbps and Kilopackets per second (Kpps).

Throughput Without Firewall in Kpps

Tolly engineers tested the performance of each solution with three packet sizes. Engineers found the Ubiquiti EdgeRouter Lite delivers consistently higher throughput in both Mbps and Kpps than the MikroTik RB1100AHx2. See Figure 1.

Ubiquiti Networks, Inc.

EdgeRouter Lite

GbE Routing Performance

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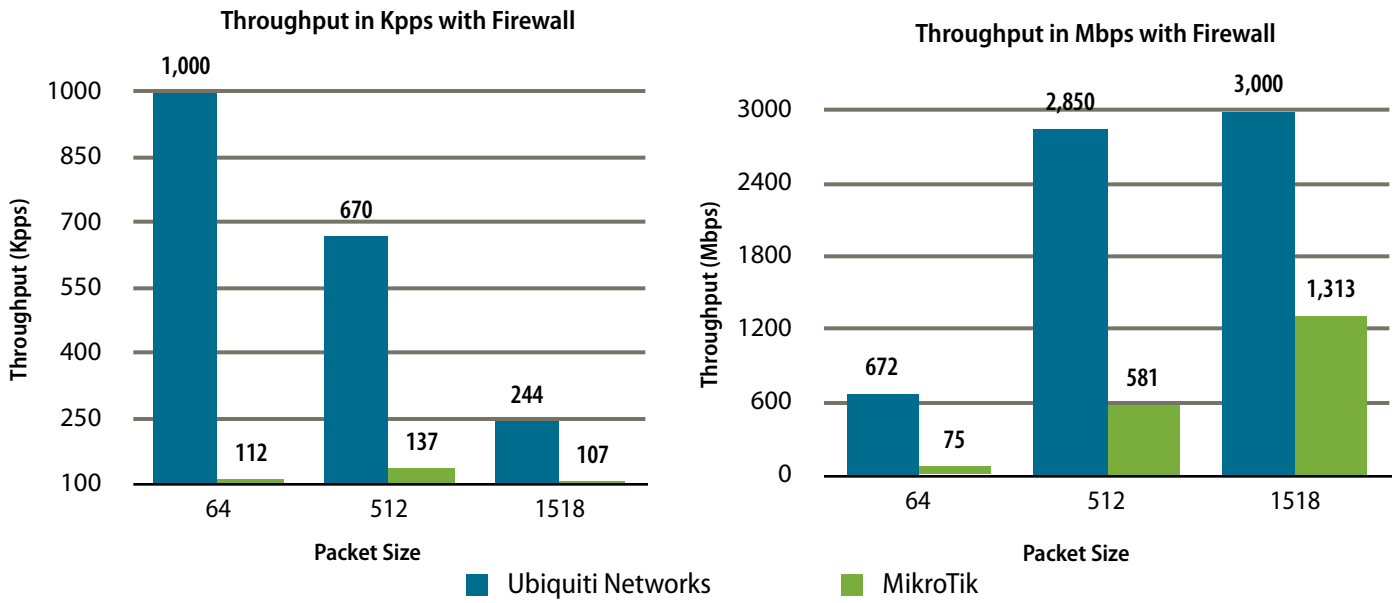
Tested June 2012

The EdgeRouter Lite performed the best across all packet sizes forwarding over 1,000 Kpps (1 million pps) of 64-byte packets, 704.9 Kpps of 512-byte packets and 243.8 Kpps of 1518-byte packets.

The MikroTik RouterBoard provided lower performance across all three packet sizes. Forwarding 204 Kpps of 64-byte packets,

Layer 3 Bidirectional Gigabit Throughput With Firewall in Mbps and Kpps
As reported by Spirent TestCenter

(Higher values are better)



Note: All products tested using three active GbE ports. Spirent throughput metrics include 12-byte Ethernet IFG.

Source: Tolly, June 2012

Figure 2

188 Kpps of 512-byte packets and 153 Kpps of 1518-byte packets. See Figure 1.

Throughput Without Firewall in Mbps

The EdgeRouter Lite forwarded 672.3 Mbps for the 64-byte packet size, while MikroTik forwarded 137 Mbps. See Figure 1.

For the 512-byte and 1518-byte packet sizes, Ubiquiti demonstrated 100% line rate forwarding at 3000 Mbps.

MikroTik demonstrated significantly lower throughput for the 512-byte and 1518-byte packet sizes, at 799 Mbps and 1,882 Mbps, respectively.

Firewall Throughput in Kpps

To assess performance in a real-world scenario, Tolly engineers evaluated each solutions' throughput in Kpps and Mbps with a firewall enabled.

Ubiquiti's performance was unaffected by the addition of a firewall, still delivering the highest throughput across all packet sizes tested. On average, Ubiquiti delivered 4.3X more throughput in Kpps with a firewall than MikroTik. See Figure 2.

The EdgeRouter Lite forwarded over 1,000 Kpps (1 million pps) for 64-byte packets, while MikroTik's performance suffered with the addition of a firewall, delivering significantly less throughput at 112 Kpps. See Figure 2.

For the 512-byte packet size, Ubiquiti was able to forward 669.6 Kpps, over 3.8X more than MikroTik at 137 Kpps.

For the 1518-byte packet size, the EdgeRouter Lite again delivered higher throughput than MikroTik. Ubiquiti delivered 243.8 Kpps while MikroTik delivered 107 Kpps.

Firewall Throughput in Mbps

On average, across all packet sizes, the Ubiquiti EdgeRouter Lite forwarded 2.3X more Mbps than MikroTik. See Figure 2.

The EdgeRouter Lite forwarded 672.3 Mbps 64-byte packets, while MikroTik forwarded only 75 Mbps.

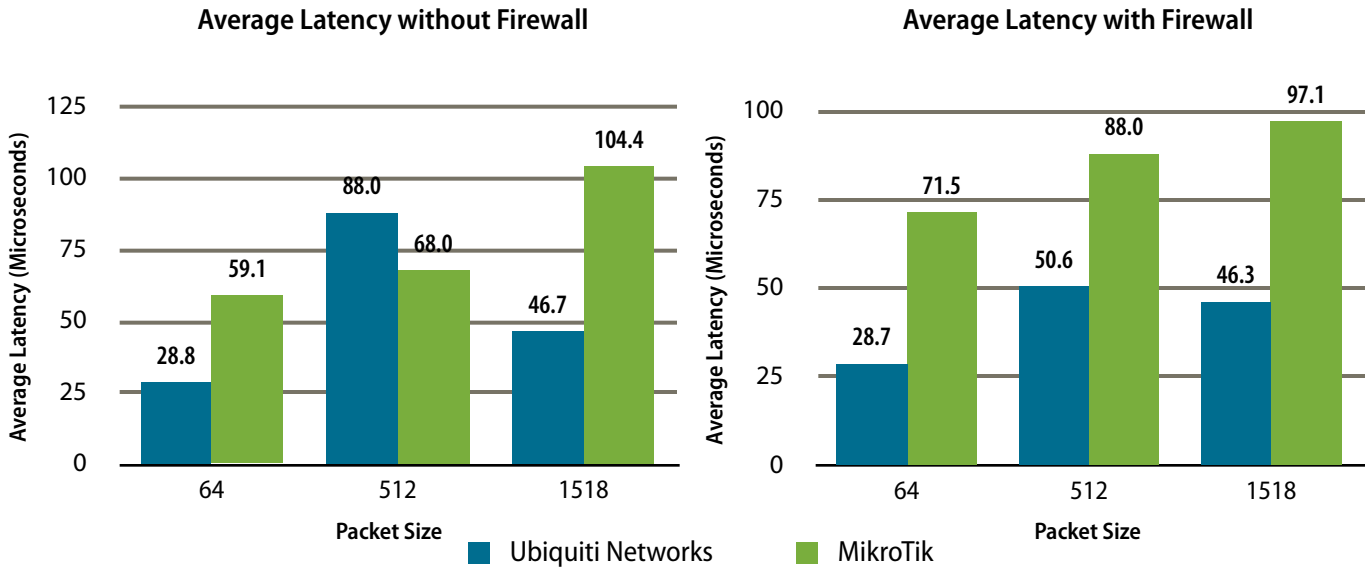
EdgeRouter Lite forwarded 2,850 Mbps of 512-byte packets, while MikroTik forwarded 581 Mbps.

For the 1518-byte packet size, EdgeRouter Lite demonstrated 100% line rate at 3,000 Mbps, while MikroTik forwarded 1,313 Mbps.

Layer 3 Average Latency (Microseconds)

As reported by Spirent TestCenter

(Lower values are better)

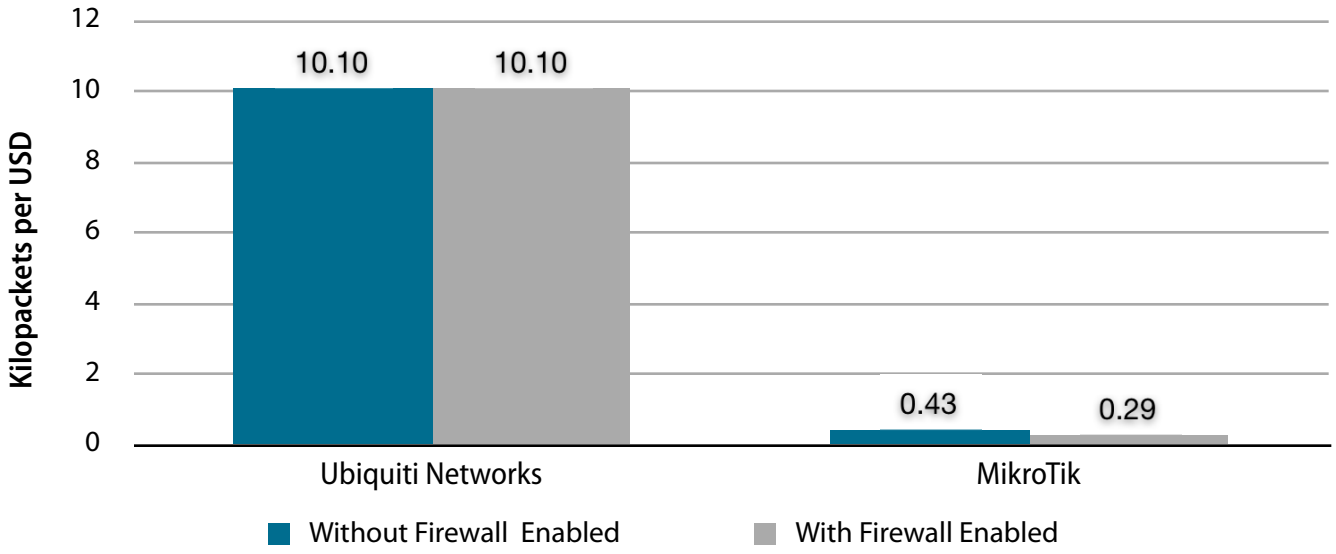


Note: All products tested using three active GbE ports. Spirent throughput metrics include 12-byte Ethernet IFG.

Source: Tolly, June 2012

Figure 3

Bidirectional Gigabit Ethernet LAN Routing Price/Performance Comparison: Kilopackets per US Dollar (USD) With and Without Firewall Enabled



	Bidirectional Gigabit Ethernet LAN Routing Price/Performance Calculations: Kilopackets per USD			
	Ubiquiti EdgeRouter Lite		MikroTik RB1100AHx2	
	No Firewall	**Firewall Enabled**	**No Firewall**	**Firewall Enabled**
Kilopackets	1000.4	1000.4	203.7	136.6
Reseller Price (USD)	$99		$475	
Kilopackets per USD	**10.10**	**10.10**	**0.43**	**0.29**

Notes: Pricing for MikroTik was obtained by Tolly engineers from Balticnetworks.com in June 2012. As EdgeRouter Lite was in pre-release at the time of this evaluation, its pricing information was provided by Ubiquiti. 1 Kilopacket = 1,000 packets. Tolly utilized the best performance numbers for each solution. For EdgeRouter Lite, 64-byte packets were used in the calculation for both with and without firewall. For MikroTik 64-byte packets were used for "No firewall", and 512-byte packets were used for "Firewall enabled."

Source: Tolly, June 2012

Figure 4

Latency

Tolly engineers measured the system latency with and without a firewall enabled. For most packet sizes, Ubiquiti EdgeRouter Lite provided significantly lower latency than the MikroTik RB1100AHx2.

Without Firewall

Without a firewall enabled, Ubiquiti's average latency for forwarding 64-byte packets was 28.8 microseconds (µs), compared to 59.1µs for MikroTik. See Figure 3.

For 512-byte packet sizes, EdgeRouter Lite's average latency was 88 µs. MikroTik had lower latency at 68 µs.

For 1518-byte packets, EdgeRouter Lite demonstrated significantly lower latency at 46.7 µs, compared to MikroTik at 104.4 µs.

With Firewall Enabled

Tolly engineers enabled a firewall and measured average latency across all three packet sizes. Ubiquiti's performance was unaffected, demonstrating low and in some cases lower latency than without the firewall, across all packet sizes. See Figure 3.

For 64-byte packet sizes, EdgeRouter Lite performed slightly better than its latency without a firewall enabled, demonstrating 28.7 µs of latency, compared to 71.5 µs for MikroTik.

For 512-byte packets, Ubiquiti demonstrated lower latency, at 50.6 µs while MikroTik came in significantly higher, at 88 µs.

For 1518-byte packets, EdgeRouter Lite provided the lowest latency at 46.3 µs compared to 97.1 µs for MikroTik.

Price/Performance Comparison

Kilopacket per USD

To demonstrate the price/performance value of the Ubiquiti EdgeRouter Lite compared to the MikroTik RB1100AHx2, Tolly engineers calculated how many thousand packets per second (Kpps) of throughput are delivered per dollar of cost. The Kpps per dollar calculation uses the highest Kpps throughput data for each solution.

At over 10 Kilopackets per USD (both with and without a firewall) Ubiquiti's EdgeRouter Lite represents the greatest value for customers. The MikroTik RB1100AHx2 retails for significantly more than Ubiquiti's $99 USD at $475 USD. See Figure 4 .

The MikroTik RB1100AHx2 delivers .43 Kilopackets per USD without a firewall, and .29 Kilopackets per USD when a firewall is enabled.

Test Setup & Methodology

Test Bed Setup

The test bed consisted of the devices under test (DUTs), connected directly to a Spirent TestCenter SPT-2000 traffic generator equipped with one CM-1G-D12 line card equipped with 12 10/100/1000 Dual Media GbE ports.

The devices under test were equipped as detailed in Table 1. Each DUT was connected to the Spirent traffic generator using three GbE ports. CPU in the MikroTik was running at the default 1066 MHz.

RFC 2544 Performance

Baseline Performance without Firewall

To test the baseline performance of each DUT, engineers reset the devices to their factory default configuration. IP forwarding was enabled, but firewall and connection tracking features were disabled.

Three GbE ports on each DUT were connected to the Spirent TestCenter, and configured in a full-mesh topology - i.e. each port sends and receives traffic from every other port.

The Spirent TestCenter application running on a Windows PC was used to configure the parameters of the test traffic following the methodology specified by RFC 2544. Tests used binary search algorithm to determine the maximum zero-loss throughput for the packet sizes of 64, 512 and 1518 bytes and protocol UDP. Throughput was measured in terms of Megabits per second (Mbps) and Kilopackets per second (Kpps). Last In First Out (LIFO) algorithm was used to measure the average latency, measured in microseconds (µs).

Each test iteration was run with a 60 second duration, and each test repeated three times to ensure repeatability of results.

Performance with Firewall

To test the performance of each DUT with firewall turned on, engineers reset the devices to their factory default configuration. IP forwarding and firewall features were enabled, but connection tracking features were disabled.

Three GbE ports on each DUT were connected to the Spirent TestCenter, and configured in a full-mesh topology - i.e.

each port sends and receives traffic from every other port.

The Spirent TestCenter application running on a Windows PC was used to configure the parameters of the test traffic following the methodology specified by RFC 2544. Tests used binary search algorithm to determine the maximum zero-loss throughput for the packet sizes of 64, 512 and 1518 bytes and UDP port number 1024. Throughput was measured in terms of Megabits per second (Mbps) and Kilopackets per second (Kpps). Last In First Out (LIFO) algorithm was used to measure the average latency, measured in microseconds (µs).

On each DUT, 25 stateless firewall rules were configured in the form of Access Control Lists (ACLs) to allow traffic matching a particular UDP port number. The first 24 rules do not match the test traffic, while the 25th rule is configured to allow traffic with the UDP port number 1024, matching that of the traffic. Each packet of the test traffic gets processed by each of the 25 ACLs defined in the firewall component of the DUT.

Each test iteration was run with a 60 second duration, and each test was repeated three times to ensure result continuity.

Test Equipment Summary

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

Vendor	Product	Web
TESTED WITH SPIRENT	**TestCenter SPT-2000**	www.spirent.com

Device Under Test - Version Information

Device Under Test	Details	Software Version
Ubiquiti EdgeRouter Lite	Three 10/100/1000 Mbps Ethernet ports Dual-core 500 MHz MIPS64 processor with hardware acceleration for packet processing	Version 0.9.5
MikroTik RB1100AHx2	Three 10/100/1000 Mbps Ethernet Ports and ten switched GbE ports (in two groups) Dual-core 1066 MHz PowerPC P2020	Software version: 5.18

Source: Tolly, June 2012

Table 1

About Tolly…

The Tolly Group companies have been delivering world-class IT services for more than 20 years. Tolly is a leading global provider of third-party validation services for vendors of IT products, components and services.
You can reach the company by email at sales@tolly.com, or by telephone at +1 561.391.5610.

Visit Tolly on the Internet at: http://www.tolly.com

Interaction with Competitors

In accordance with Tolly's Fair Testing Charter, Tolly personnel invited representatives from the competing companies to review the testing. MikroTik did not respond to Tolly's invitation.

For more information on the Tolly Fair Testing Charter, visit:
http://www.tolly.com/FTC.aspx

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